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The summer meeting of the American Society of Mechanical Engineers is held this year at Detroit, June 23 to 26, conflicting to some extent with this convention of the Master Mechanics' Association. It is probable that some railroad mechanical engineers are attending the Detroit meeting and are thus compelled to give up this meeting at Atlantic City, and while it would be possible for some in attendance here to remain until the conclusion of the Master Mechanics' meeting on Wednesday and go immediately by night train to Detroit and be in time for the last day's session of the Engineers' meeting on Friday, only the requirements of most important business would suggest such a movement. These two associations should not be holding meetings the same week, even if they were in the same place, and it is to be hoped that this year's coincidence will not be repeated.

The visitors at the railroad conventions in Atlantic City last week were so much interested in what was going on here that they did not pay much attention to what was going on at the much larger political convention in Chicago. They had an opportunity on Saturday and Sunday to read in the newspapers of the developments at Chicago, and they read of them with a sense of relief. The platform adopted by the republican party is not a conservative one, but the planks relating to railroad regulation and to the issuance of injunctions in labor disputes are so much less radical than those proposed by the more violent railroad and corporation baiters as to inspire hope that the anti-corporation campaign is spending its fury. The extreme radicals wanted a plank demanding a physical valuation of all railroad properties by the federal government "to be made the basis of just and equal railway rates." The fathering of such a proposition by a great political party would have impaired the returning confidence in railroad securities and delayed the revival of improvements and construction and the reopening of the shops, which all railroad men hope will not be much longer delayed. The adoption of the proposed plank for greatly restricting the issuance of injunctions in labor disputes would have encouraged and enabled labor leaders to make even more trouble for large employers, including railroads, than they have made in recent years. Even the reference to injunctions, when nobody ever has been able to cite a single specific instance where labor was injured by their issuance by a federal court, is to be regretted; but what the platform says is much better than what there was great reason to fear it would say. The republican platform reflects the change that is taking place in popular sentiment toward railroads and other corporations. The pinch of hard times is teaching the people a lesson in economics that the most logical and forceful arguments were insufficient to inculcate.

The members of the Master Mechanics' association will have an opportunity to attend some of the sessions of the American Society for Testing Materials which opened its sessions at Hotel Traymore yesterday. At the meeting on Tuesday evening the annual address by the president, Dr. C. B. Dudley, was on "Some Features of the Present Steel Rail Question," and there are four papers on the corrosion of iron and steel. At the meeting on Wednesday morning there is to be a report on the tempering and testing of steel springs and standard specifications for steel springs by J. A. Kincaid. Also one on "Tests of Staybolts," by E. L. Hancock. The meeting on Wednesday afternoon at 3 p.m. relates entirely to rails and there are seven papers and reports on that subject. The meetings on Thursday will be concerned with cement and concrete. On Friday at 10 a.m. the morning will be devoted to "Preservative Coatings for Metals," and there are three papers and reports on that subject. At the meeting Friday afternoon there is to be a report on "Uniform Specifications for Boilers," by E. E. Meier, and on Saturday morning reports on "Strength and Stiffness of Timber" are scheduled.

The setting for the June conventions of 1908 is better than that of any of its predecessors. It is the natural as well as the polite thing to say that each convention is better than those that have gone before and it usually is a perfectly true statement because the character of these conventions has been constantly improving year by year. But the concentration on Young's convention pier of the exhibits, the convention hall and the facilities for pleasing entertainment on a large scale, taken in connection with the proximity on the boardwalk of almost unlimited hotel accommodations, gives an opportunity for convention work of a most exceptional character. It is true that the concentration of hotel facilities is not so great as at Saratoga—that is to say, a given number of people cannot be taken care of in Atlantic City within the compass of two or three blocks so readily as at Saratoga, but it is idle to discuss such a detail. Atlantic City is pre-eminent as far as good hotels are concerned. The exhibits at Saratoga necessarily partook more or less of the nature of lawn parties. There were no structures suitable for housing a display so extensive as that now at Atlantic City. Furthermore, the verandas and the beautiful gardens of a pleasure resort hotel are not adapted to the requirements of a machinery show, nor can they ever give the compact and finished result that we have this year. The matter of a convention hall, which was always a sore spot at other places, has been happily solved by the new structure at the ocean end of Young's convention pier. We have here a hall large enough to meet the needs of the meetings and not so large as to make it impossible to speak with comfort or hear with ease. The happy solution of many of the difficulties which have surrounded the conventions in the past has been

reached by the co-ordinated and indefatigable efforts of the two railway associations, the Railway Supply Manufacturers' Association and the Atlantic City Hotel Men's Association. The officers and authorities in each of these bodies should receive the congratulations as well as the hearty thanks of all those who prticipate in the conventions.

THE TRACK EXHIBIT.

It is a characteristic of the exhibits at the June conventions that they are generally representative of the latest developments of railroad equipment and appliances, and in recent years the tendency to exhibit only the new designs has become more marked; apparatus once shown is withdrawn and the next year replaced by something of later design. This is particularly true of the track exhibits on Mississippi avenue, where there are shown several cars that are representative of the work of the past year.

A few years ago the railroad world was more struck by the novelty of the steel car than is the case today. This is not because men have ceased to work on its improvement, but because when the first steel cars were shown at Saratoga they were novelties throughout and each designer had some one idea to promulgate, with the result that he carried it to an extreme. For example, in the rivalry between pressed steel and shape construction, each party carried the one idea throughout the whole car; the car of pressed steel was of pressed steel in every part to the exclusion of all shapes, and vice versa, in perfect disregard of the probability that each class of material would have its proper place in the scientifically designed car. This mutual exclusiveness is now of the past, and, in the cars shown this year there is a proper intermingling of the two classes of material, with a marked tendency towards the use of shapes for the heavier parts and of pressed steel for the lighter. This does not hold in every case, however, as the car with heavy pressed steel side sills is very much in evidence. Some designers have considered that the fish-belly pressed steel sill is superior to the straight shape of uniform section and so there is found in one car an exceedingly deep center sill with cross-ties carrying the whole load back to it. In another the same form is obtained by splitting a channel and drawing the flanges together at the ends. The same end is also reached without the splitting of the web in the case of bolsters, thus giving a combination of shape and pressed metal in the same piece.

This combination feature also indicates the end of the transition or tentative period of steel car construction and definitely announces that the type has been firmly established and that the future variations of details will be due more to the exigencies of particular service than to any great difference of opinion as to the general principles of design, just as the old wooden car has been developed through a multitude of designs to one general form that may be regarded as the standard of American railroads.

With this acceptance of the steel freight car has naturally come the steel passenger car, a most excellent example of which is shown on the Mississippi avenue tracks. Here again is found a predominance of shapes even to the trucks. In these the wheel pieces are of shapes resting on journal box springs as in the case of the freight truck, and the springs are carried by hangers and are set well out, with the side bearings held by brackets beneath the side sills so that rolling is reduced to a minimum. This car also proves the acceptance of the steel car in that the early attempts at an exact imitation of wood and the concealment of the rivet heads has been abandoned, and he who runs may read the evidences of the steel construction in every part inside and out. That this has not detracted from the artistic beauty of the design is apparent, for it would be difficult to produce a more attractive interior than that presented by this steel car with its delicate green coloring that is a perfect symphony of its shades, in ceiling, deck lights, sides, cushions and flooring, and yet every part, barring the window sash, even to the arm rests, is of steel. This is ample demonstration that steel lends itself readily to beauty of design both as to form and color, and that the attempt at the barbaric splendor for so many years characteristic of the interior decorative scheme of American passenger cars is a thing of the past.

Near this steel car is another in the form of a gasoline-electric motor car which shows that this type of independent vehicle is under consideration and that there is a recognized field for its employment. The difficulty of starting and the desirability of running a gasoline motor at a uniform speed, coupled with the difficulties attendant upon a purely mechanical connection between the motor and the wheels, with the complications inherent in reversing, makes the gasoline-electric car peculiarly attractive and a design which promises to become an important element in the operation of light traffic branch lines.

Naturally, as wooden frames were first definitely abandoned in tender frames and the metal shape construction there adopted, it follows that the tender frame should still lead the freight and passenger car in the types evolved, and so it is quite a matter of course to find the cast steel tender frame shown. Steel castings of increasing intricacy of form have been offered to the railroads for a number of years; they have been applied in many different ways in both locomotive and car construction. To those who have been in touch with this development of steel castings and have followed the art from the days when the words were synonymous with blow-holes, so thoroughly were the early attempts honey-combed, the production of a steel casting of the magnitude of a tender frame appears as no mean accomplishment. Equal in interest to the casting itself, is the fact that the makers have seen fit to exhibit it just as it came from the sand, and with all the marks indicative of the means that have been taken to avoid swelling of the molds, washing of the sand, cracking at the fillets, honeycombing in the cope and all the other defects to which steel castings are liable. The exhibit is of interest not only in the construction of a single-piece tender frame, which eliminates the troubles with joints that are prevalent, but as a metallurgical triumph of the first order in that such a piece of work can be successfully poured.

Near the tender frame are shown cast steel locomotive rods and frames. These are substantial pieces of work as smooth as though finished in a tumbler, and would have been regarded a few years ago with wonder at their external appearance and skepticism as to their internal soundness. But now, they are common property of the railroad world, used with perfect freedom, and taken as a matter of course, without thought of their recent development, because of the later novelties produced by the metallurgist.

Yet another striking example of the growth of a department is to be found in the air brake instruction car. It is not so very many years since the use of the air brake on freight cars was first advocated, and the celebrated Burlington tests are now but 21 years in the past, tests that nearly failed because of the insistence of their organizer that trains of 50 cars should be used. Then came a period when air brake instruction was perfunctory, and confined to the engineers, and even these men picked up in service the greater portion of their skill and information. Now air brake instruction cars are on all roads of any importance and these cars are equipped, as in the case of the Central of New Jersey car exhibited, with every possible device for the elucidation of the subject, and with comfortable living quarters for the demonstrators and instructors.

These are the main features of the track exhibit at the 1908 conventions and the lesson that can be read from them.

Conventionalities

Watson & Stillman are handing out a paper cutter and letter-opener as a souvenir.

Lost—Badge 6007. Reward and no questions asked. Return to Railroad Age Gazette office.

E. B. Leigh, President of the Chicago Railway Equipment Company has as yet not been seen at either convention to the regret of all.

Miss Fowler lost a camera on the street car returning from the ball game. Information leading to its recovery will be appreciated.

The smiling happy face of A. J. Farley of the Chicago Railway Equipment Company is missed by all the visitors to the conventions.

Lost—Ladies badges Nos. 5031 and 4007 have been lost. The finder will please return them to the Railroad Age Gazette office, convention pier.

James D. Ramsey has resigned as superintendent of motive power of the Calumet & Hecla, having been in railway service for 40 years.

John F. Miller, vice-president of the Westinghouse Air Brake Company, was in attendance at the convention the first three days and returned home on Saturday.

William Marshall, of the Anglo-American Varnish Company, as usual was happy in the selection of a souvenir—not other peoples—but to spread the name Anglo-American.

Cary W. Martin is attending the convention and states that he has gone into the railway supply business, having established his office at No. 1 Wall street, New York City.

It is reported that L. H. Van Allen, general superintendent of the western district of the New York Central, will shortly be made assistant general manager of the New York, New Haven & Hartford.

Found—A parasol, left on the grand stand at the ball game on Saturday. The owner may obtain it by calling upon C. P. Storrs, chairman entertainment committee, at Room 265, Marlborough-Blenheim.

Lost—On Thursday evening, June 18, at the M. C. B. ball, a valuable monogram "I. C. S." pin, mounted with diamonds and emeralds. The finder will be rewarded upon returning same to the owner, Mrs. W. N. Mitchell, Room 223, Traymore Hotel.

One Daniel M. Brady has lost, probably in machinery, a cane of not much value to himself or any one else except that it would improve Mr. Brady's faith in human nature if the finder would return it, as his initials are engraved on the handle.

W. F. Roberts of the Roberts Supply Company, Keystone building, Pittsburgh, Pa., is attending the conventions. The company is agent for a number of railroad specialties and Mr. Roberts is now arranging to add one or two more good appliances to his list.

The "Old Songs by the Old Crowd" in Entrance Hall on Tuesday morning were "bully." Vesella and his band set the pace, Clayton W. Old led the "Old Crowd," the rest of the crowd joined in the choruses, and the good, old, popular songs were sung so that the resonance filled the hall, and rolled out upon the boardwalk and the ocean. And it was good music, too—the kind of good music that can be made only by a lot of rich, strong masculine voices, in the throats of real men, who don't desire to do a precious thing but sing.

Mrs. R. C. Hallett, room 348, Haddon Hall, lost a string of large gold beads (presumably near the Young's convention pier), on Tuesday morning. It is hardly necessary to say that Mrs. Hallett will be very grateful to the person who will return them to her.

Mr. Hughson of the John Davis Company, Chicago, manufacturer of the Hughson regulating valve has a number of souvenirs in the shape of a cigar ash tray that he would like to present to any of the members that have not already received one. He can be found at booth No. 309.

Jack Turner, of the Pressed Steel Car Company, was called away on Friday night on important business, and his friends have not only missed him but are wondering whether the call was to close an order for "10,000 or more" pressed steel cars.

E. H. Sniffen, manager of the Westinghouse Machine Company, accompanied by L. L. Drinsmade, manager of the New York office of that company, arrived at the convention on Saturday, having made the trip from New York in an automobile.

The Hon. John B. Corliss, president of the Michigan Lubricator Company, accompanied by his daughter, Miss Corliss, and Mr. George Holly of Holly Brothers Company, all of Detroit, arrived yesterday and are stopping at the Marlborough-Blenheim.

The following names of members of the "Rube" band that discoursed sweet music at the ball game were inadvertently omitted from the list given in the account of the game in Monday's Daily: J. S. Seabury, Joseph Reed, A. E. Robbins, C. A. Knill, Frank A. Morrison, M. Bolles.

Many of the exhibitors at the convention are taking their cutting tools and drills to the Wm. Sellers & Co. booth, 164-166, to be ground on the tool and drill grinders which this company is exhibiting. Wm. Sellers & Co. are very glad to accommodate those who desire to avail themselves of the use of these machines.

On account of important business matters D. J. Champion, the genial vice-president and general manager of the Champion Rivet Company, Cleveland, Ohio, has been unable to attend the convention. W. S. H. Bateman, sales agent for the company, received advices by wire and letter to this effect on Monday.

After accomplishing its ends, the republican national committee sent J. H. Mitchell, manager Chicago sales office of the Pressed Steel Car Company, on to the Master Car Builders' convention, where he will join the sales staff of the company in "car talk," and incidentally, tell his friends what happened in Chicago.

"The sun, the moon and the stars seem to have taken a delight in the last few hours in shining upon you," said Mayor Stoy in his address of welcome. If the sun, the moon and the stars have taken as much pleasure in shining as the visitors have in being shone upon they will keep it up until late on Wednesday afternoon, June 24.

The entertainment features incidental to the conventions have been a success throughout. Their success has been mainly due to the indefatigable and resourceful efforts of Charles P. Storrs, general chairman of the entertainment committee, and of the chairmen of the sub-committees. It is worth while to mention their names once more in order that full credit may be given where great credit is due. The following have acted as chairmen of the sub-committees:

Reception committee, Bertram Berry; Master Car Builders' ball, E. H. Walker; Master Mechanics' ball, J. Will Johnson; vaudeville, Cornell S. Hawley; baseball, S. W. Midgley; door, F. O. Brazier; informal dance, Ross F. Hayes; introduction, W. J. Walsh; ushers, C. M. Garrett.

"Doc" Schumaker, the popular representative of the Carborundum Company in the breezy west, blew in Thursday from Cheyenne, Wyo. "Doc" says he is glad to get to the seashore and have a change of diet. He seems to prefer the Little Neck Clams of Atlantic City to the jack rabbit stew as they get it, seasoned with sage brush, in Old Cheyenne.

Houston Lowe is not with us this year. It is to be hoped he will show up before the conventions come to a close. Mr. Lowe represents the Lowe Brothers Company, of Dayton, Ohio, and has been a familiar attendant at these annual gatherings for a great many years; in fact he would surely have joined the "Old Timers Association" if he had been here.

Watch Found—E. A. Suender, of Reading, Pa. who has been stopping at Young's hotel, found a lady's gold watch on the convention pier on Tuesday. Mr. Suender left Wednesday evening for his home, but the loser can recover the watch by addressing him at 827 North Second street, Reading, Pa., and giving a correct description of the watch.

Some kind friend has suggested, in speaking of the very attractive number-badges given to members of the Master Car Builders' Association, that it is fortunate that the same shape of badge was not issued to the supply men; otherwise, before the close of the convention it might reasonably be supposed that a convention of ambulance surgeons was in session.

The ink pencil souvenir which the Parkesburg Iron Company is distributing is intended by its quality to typify the character of charcoal iron tubes which the company proposes to place on the market in September when its new tube mill will be completed. The Parkesburg exhibit is in booth 390 where H. A. Beale, Jr., George Thomas, 3rd, Chas. L. Humpton, John Humpton and W. H. S. Bateman are in attendance.

Owing to the fact that Mrs. Mary Jordan FitzGibbon was unable to make arrangements with the church in whose choir she sings to be absent last Sunday she was unable to appear on the special musical programmes at the Marlborough-Blenheim. John Barnes Wells, one of the leading tenor singers of New York City, was secured in her place. Mr. Wells sang with the Marlborough-Blenheim orchestra on Sunday at 11 a. m. and 9 p. m.

John R. Blakeslee, president of the Ajax Manufacturing Company of Cleveland, arrived on Monday. A. L. Guilford, Chicago manager of the company, and J. A. Murray, New York manager, are remaining for the Master Mechanics' convention. The Ajax Company, in spite of the depressed times, is maintaining its strong selling force and securing its share of the business. Mr. Blakeslee reports some very recent inquiries of a promising nature for forging and upsetting machines and bolt and nut machines.

Hon. Wm. Martin, consul-general of the United States at Hankow, China, is spending a few days at the convention, meeting old friends. He is stopping at Haddon Hall. Mr. Martin was the pioneer in steam heating of railway cars from the engine and for many years president of the Martin Anti-fire Car Heating Company. After ten years in China, where the habits and customs of thousands of years ago are still perpetuated, he says he is amazed to find the enormous advancement made by the manufacturers of railway supplies, and predicts that it will lead to a permanent exhibit being established somewhere convenient for railway officials to attend. He also states that if the manufacturers of the United States would establish such an exhibit in the empire of China it would do more toward establishing trade in the orient than all the catalogues and literature in the world. Mr. Martin expects to return to China in a few weeks to again assume the duties of his office.

A special vaudeville program was given in Entrance hall Monday night. The supply men sang some songs, and the following appeared: George H. Wood, "The somewhat different comedian;" Edna Phillips and company, in the one-act comedy, "Lost—A Kiss in Central Park;" Sadie Jansell, late feature in the musical comedy success, "The Waltz Dream;" the Avon Comedy Four, in their singing skit, "The New Teacher;" the Elsinore Sisters, in "The Actress and the Maid;" and Barnold's animals, in a pantomimic comedy entitled "Dogville."

Evidence obtained by the use of the camera is considered satisfactory even in the courts. Members have a way of straying into the convention hall half or three-quarters of an hour late. President McIntosh puts these two statements of fact together and establishes an innovation. On Tuesday morning, just after the hour set for the opening of the session in the Greek Temple a photograph will be taken of those in attendance. If the face of any member whose name appears on the register does not appear in the picture he will have to buy up the whole issue or be the subject of certain inferences.

In order to decide the knotty question which is the handsomest lady and the finest looking man at the conventions, the "Kewanee Union Club" has been formed with headquarters at the booths of the National Tube Company, Nos. 400 and 402. A neat badge is provided for all members, each bearing a number which is recorded on a register. On Wednesday a drawing will take place. The ladies' prize is two fine leather sofa pillows and the gentlemen's prize is a fine alligator-skin bag. Club members wearing the badge of the order are in evidence all over the pier and are waiting with interest the decision.

Patrons of the "Tickler," an amusement device installed near the end of the pier, will discover the application of an interesting mechanical principle as well as some other things before the conclusion of the ride. The carriage consists of an annular seating space about eight feet in diameter, in which several persons can be seated comfortably. Its track is on an inclined plane with heavily corrugated side walls—a plan of it looks like a diagram of the path of steam through a steam turbine. As the carriage moves down the plane, it just naturally rolls first on one side wall and then on the other, going a short distance like the hands of a clock and then turning with more or less suddenness so that it rolls the other way. The passengers reverse with it whether they feel like it or not.

Cass L. Kennicott, vice-president and general manager of the Kennicott Water Softener Company, arrived at the convention on Saturday last. Mr. Kennicott has missed the two preceding conventions, due largely to the fact that he has been devoting his time and energies to the development of the foreign business of the company and to the extension of the plant in Chicago. The results of the labors in the foreign field are shown in the installation of Kennicott apparatus in the Rand mines at Johannesburg, South Africa, the Kimberly diamond mines and plants for the Natal government railways at Ladysmith and Mafeking. The company has also made many installations in Europe, among others at the Krupp works at Essen, Germany, and at the Edison Company at Milan, Italy. The plant at Chicago now covers five acres of ground and the company has added to its line of productions steel tanks for the storage of water and oil, water tube boilers,

and boiler washing systems under the patents of A. R. Raymer, of the Pittsburg & Lake Erie. Mr. Kennicott has recently added to his duties the general sales management of his company.

The Purdue Dinner.

The first annual dinner of the Purdue University alumni, members of faculty and students was held in the Marlborough-Blenheim on Saturday evening, June 20th. The dinner marked the first definite movement of the organization formed last year at the suggestion of Dr. W. F. M. Goss, and proved a success, both in point of attendance and in the securing of a more permanent organization. A committee of three will have entire charge of the arrangements for the dinner of next year and plans are now being made for a reunion of Purdue men in the railroad and railroad supply business next year that will make it one of the events of the convention.

The officers of the association are: Dr. W. F. M. Goss, honorary chairman; E. E. Silk, president; F. B. Ernst, vice-president; J. H. Joschka, secretary. The committee in charge of the annual dinner for next year is composed of F. B. Ernst, F. E. Lister and J. L. Connors. Among the members of the Purdue University association in attendance at the dinner and convention were: Dr. W. F. M. Goss, J. E. Muhlfeld, D. Royse, G. E. Parks, J. C. Whitridge, E. E. Silk, F. B. Ernst, Chas. Barrett, C. H. Fry, R. Adreon, M. W. Priseler, R. Hitt, H. H. Newsom, H. W. Coddington, F. E. Lister, J. F. Reed, H. A. Smith, J. H. Cunningham, J. M. Henry, Tabor Hamilton, C. D. Porter, J. L. Connors, H. S. Noble, R. B. Watson, Paul Weiler, E. J. Wolf, W. L. Robinson, Reisner, Hackett, McIntosh and F. S. Robbins.

Master Mechanics' Annual Ball.

The forty-first annual ball of the American Railway Master Mechanics' Association was given in Entrance Hall, convention pier, on Tuesday night, at 9.30 p. m. It was one of the most successful social functions in the history of the association. The attendance was large, the gowns were beautiful and the programme was of a very superior, and in some respects novel, character.

Seats for President and Mrs. McIntosh and the other officers of the association and their wives were reserved at the southwest corner of the hall, near the aquarium. When the officers and their ladies walked across the hall to their seats Beal's Orchestra played "Hail to the Chief." The grand march, which was conducted by J. Will Johnson, and was led by the officers of the association and their ladies, was from the southwest corner of the hall to the southeast corner, thence clear around the hall and back in front of the aquarium, thence northward through the middle of the hall. At the north end the couples turned alternately to the right and to the left, the two columns proceeding to the west and east sides of the hall, respectively, and thence back to the aquarium. Here, as each column turned to cross the hall diagonally, each lady was handed a Japanese parasol unfurled. The columns crossed each other at the center of the hall, proceeding, respectively, to the northwest and northeast corners. They then marched south and united into a single column in front of the aquarium. From here the march was north and then east to the first pillar on the east side of the hall, thence north to the next pillar, thence across the hall to the corresponding pillar on the west side; and in this manner the marchers went to a position in front of each of the pillars until they reached the front end of the hall where they were photographed. A member of the entertainment committee stood at each pillar to guide the marchers.

The hall, as the marchers proceeded up and down and across the room, the ladies in their variedly beautiful gowns, surmounted by umbrellas of all and more than all of the colors of the rainbow, the lights above presenting almost as many colors as the umbrellas, was a novel, picturesque and charming picture that will not be soon forgotten by the many who saw it. The various unique features of the march were worked out by J. Will Johnson, chairman of the Sub-committee on the Master Mechanics' ball, to whose tireless work the success of the function was largely due. The other members of the sub-committee, all of whom did yoeman service, were A. G. Langstrom, John M. Stayman, Phillip J. Mitchell, and J. C. Younglove.

Envy.

As an illustration of the feelings of those who want to come to the conventions and cannot, the following letter received by the general chairman of the entertainment committee is a whole volume in itself:

Pittsburg, Pa., First Day Out.

My dear Col. Storrs:

Say, I'm the extreme edge! Honest, old sport, when the original package of hard luck was wrapped up, and old man Fate was looking around all over his shop for the label and address for a sticker, he found my name in the bottom of the box, and stuck it on, and I was handed the box of real lemons! Some day this pursuit of the Evil One is going to grow too much like a cracked cone, or a hot main pin, and the humble writer is going to climb up on the flag pole on this building, hold both hands up in the atmosphere, yell out loud "Here goes nothing"—and jump off! Everything grows here but my salary, and prospects, and every time I begin to build up a chest about any doings I am about to pull away from close contact with Nature, someone comes in with a hook, and when the smoke clears away you can see my bleeding and mangled remains mashed to the semblance of the first slice of fried eggplant—on the floor below. Here I sat like the original frog on a log and figured all out how I was to make the convention get-away, and slip in there when the lookout was not sleepless or maybe looking out of life's shop window, and I had a suit of clothes that, honest, you couldn't see in one effort, a cane that made George Cohen's famous twirler look like a frapped piano-leg, white "shammi-skin" gloves, and a green tie that was first cousin to a shamrock-fest—and O, you know—proud clothes and a fixed smile and all like that—and guess the answer! No? Can't guess? Listen—"Not going"—that's ME! Also ran. Nit journey to the deep water. And all the rest of it. Say, I was so mad, I was so dam' mad that I just went out, and drank a pint of gasoline and left the nut in the bottom of the jug!

To-day a fellow offered me a Manhattan for an appetite producer, and I was afraid to drink it because it might have some hidden meaning in it and I was sure to catch it.

If you see a chance down there, laugh and think of poor little Bright-Eyes over here in Sootville weeping his young heart away on the ashpile of forgotten promises, and hoping that before Taft is spoken of for a second term, something may turn up to turn down this cussed rotten near-luck. Why, I thought that my grip on that thing was not even less than the eccentric-double-gear-backfire-exhaust of one of those 90 h. p. four-speed-ahead gasoline dashes—you know the kind—the ones that have the self-oiling device direct-connected to the front main-steering-apparatus, riveted out-sides, triple expansion mud-guards linked up to the third speed-reverse and operated by the fundamental principle which underlies the waste-oil-pan in the construction elemental type and goes so darn fast and sure that to try to switch it is like tackling the star half-back from Har-Princ-Yale-Penn Uni. all rolled up into one big bet. But the bet is off, and so am I—to waters not so deep as Atlantic nor yet so ornate, but mayhap of a no-less gratifying dampness!

Love to all the little folks, and when the circus begins to come up over the edge of your table, why, get away with perspicacity and diligence, for the time is up.

So long, as always,

_____

MASTER MECHANICS' ASSOCIATION.

Proceedings of the Second Session of the Forty-first Annual Convention.

President McIntosh called the meeting to order at 9.30 o'clock.

J. F. DeVoy (C. M. & St. P.) presented the report of the committee on "Castle Nuts."

Discussion on Castle Nuts.

H. T. Bentley (C. & N. W.): It has occurred to us that on the larger nuts with the standard thread a second hole should be placed in the bolt so as to get a finer adjustment; also that for the standard nuts of the larger diameter the slot be slightly deeper. I think the report recommends 3-16 inch below half the diameter of the pin.

A. W. Gibbs (P. R. R.): What have the manufacturers done in meeting this committee? Have any manufacturers agreed to make these nuts upon any terms?

Mr. DeVoy: The Milwaukee road is making these nuts now on a forging machine. The National Automobile Manufacturers' Association is making them. They can be made anywhere. I believe the Lake Shore is making them in a different manner.

H. P. Meredith (Penna. R. R.): Mr. Abel, of the Russell, Birdsall & Ward Nut Company, of Port Chester, N. Y., told me that his company was prepared to make nuts if it came to a question of ordering the castle nut, and was waiting until some standard was adopted by the railroads. There are about eight sets of dimensions for castle nuts. The Brill company uses one standard and the American Locomotive Company another. The Lake Shore & Michigan Southern is trying an experiment. The navy department had used some few nuts which were bought from the Russell, Birdsall & Ward Company. The manufacturers say they are ready to make any kind of castle nut as soon as a standard is laid down. They have made a good many nuts for the automobile association.

The President: While we are using castle nuts to some extent, I do not know where we get them.

B. P. Flory (Cent. of N. J.): We get a few from the Russell, Birdsall & Ward Nut Company and are trying them. We took what nuts were furnished as standard, or what the manufacturer considered standard at that time.

F. F. Gaines (Cent. of Ga.): I am not quite clear from the report whether this question is to be put to letter ballot for a standard, but if there is any doubt about it, I would like to make a motion that it should be. We buy engines from different engine builders, and each one at the present time has a different idea as to the castle nut, not only as regards thickness, but as to the kind of cotter and kind of slot in the end of the nut, and I think it is important that we have a common standard.

C. A. Seley (C. R. I. & P.): I second the motion.

Mr. Meredith: I think it would be a good thing for us to hear from some of the locomotive builders on the question.

H. H. Vaughn (Can. Pac.): We use what the committee calls "castle nuts," which I believe will be a good term for us to adopt, as it is a comparatively short term, and will be a suitable one for use in the future. We use this nut very extensively, and consider it the best and most practicable form of lock nut for locomotive use. We have our own standards, but I think the establishment of a standard like this by the American Railway Master Mechanics' Association would be valuable not only to the railroads, but to the manufacturers of bolts and nuts, but I would suggest that to make this a standard immediately would be rather a serious matter. I believe that a standard for castle nuts is required. We make them partly in the forging machine, but more often in the milling machine, as on small nuts we have found more or less difficulty in getting a sufficiently good job in the forging machine with the small cotters. It is an article that requires special machinery developed to manufacture it, and it will probably go into the hands of the manufacturing concerns rather than the railroads who can hardly equip themselves with the necessary machinery to make the nuts cheaply in limited quantities.

I propose as an amendment that this Association recommends the dimensions of castle nuts formulated in this report for use by its members during the coming year, with a view of adopting it as standard if it is found satisfactory, and I believe the committee should be continued for a year to get in touch with manufacturers of castle nuts, and with other parties with a view to establishing it as a regular standard at the end of the year, if nothing develops to the contrary.

This amendment was accepted and the motion as amended carried.

The report on "Apprenticeship System" was presented by C. W. Cross (N. Y. C. & H. R.)

Discussion on Apprenticeship System.

A. B. McHaffie (Intercolonial): It was a happy thought for the committee to make an exhibit here. There is nothing that will illustrate better the progress of the apprenticeship work.

J. Tonge (M. & St. L.): The company makes sufficient money out of the apprentice to be satisfied to give him opportunity in the day class. It is the active mind that we expect to make use of; but after its daily labor it ceases to be active. We know that from experience. Anyone who has worked 10 or 12 hours a day knows what those conditions are and I do hope that no railroad will ever propose that an apprentice shall get his instruction after 10 hours of labor.

H. T. Bently (C. & N. W.): I hardly agree with Mr. Tonge. Unfortunately we have not such a good scheme of teaching the apprentice on the Chicago & Northwestern as is set forth by the committee; but with 45 apprentices we have two apprentice instructors who follow the young men up and give them every opportunity of becoming proficient in the work they are undertaking, and I think it has had a good effect. We give a certificate or diploma as soon as the young man is out of his time which shows where he served his time and what course he has gone through. About 12 months ago the apprentices themselves organized an Apprentice Club; they have held 14 meetings and the average attendance at those meetings was 22. To show the scope of the papers and discussions that they read, I will name a few of them. The first was, "The Future of the Apprentice," and it was one of the best written papers I ever came across. Others were "The D Slide Valve," "Stephenson Link Motion," "Valve Setting," "The Air Brake," "Injectors," "Lubricators," and "Theory of Combustion."

All the 45 are members of the Apprentice Club and the officials endeavor to encourage the young men by their presence and to help them by furnishing information they are not able to obtain in any other way. This shows we still have some young men who are anxious to progress in this world.

F. F. Gaines (Cent. of Ga.): I agree with Mr. Bentley about the night instruction not taking any exception to what Mr. Tonge had to say relative to the parsimony of the railroads but rather from the fact that it has been my experience that when an appentice boy puts in his evenings studying somewhere in a school it is of decided benefit to him.

There is another thing that is not touched on in this report. What is the proper proportion of apprentices in each trade to the skilled men? Has there been any trouble with organized labor limiting the number of apprentices? I have found an advantage in a preliminary training for apprentices. If you take them in as wiper boys, messengers or other uses around the shop and weed out those who are undesirable before you even consider them as apprentices, you are apt to get much better material.

E. W. Thomas (A. T. & S. F.): At the Santa Fe Topeka shop, where we have our largest apprentice class, 163 boys, we found that it cost us about 23 cents a day to instruct these apprentices in the shop. The average rate of pay for apprentices is about $1.35 a day, making in round numbers $1.60 a day wages and cost in instruction for the apprentices. We find that we get 80 per cent as much work out of the average apprentice as we do out of the average journeyman in the shops, so that with an outlay of $1.60 in money we can accomplish 80 per cent as much work as we can by paying $3.60. We find also, as a result of the shop instruction, that we can give a higher class of work to the boys, not only doing more work, but a better grade of work. We find also that in the event some machinist is absent for a day we can put a boy on an important machine and with the assistance of an instructor keep the machine in operation.

George W. Wildin (N. Y. N. H. & H.): There is no question about the value of the instruction of the apprentices. What I would like to know is, whether we can increase the standard ratio of apprentices to skilled labor under the instruction method. Mr. Gaines asks what is a proper proportion. We know the proportion, but the proper proportion is another thing; one to five is known to be the standard proportion. I suppose you are affected like everybody else. Are we ever going to get the proper proportion of apprentices to the skilled machinists by any method of instruction? Are the skilled mechanics averse to the men who pass through the school before going into the shop more than they are to the men who have gone through the wiping gang?

I. C. Hicks (A. T. & S. F.): At San Bernardino we use the improved system of apprentice instruction. We have a practical instructor and a mental instructor. On the machine side especially, it is possible to have apprentices do the highest class of work, with the special instructor checking

the work when it is about to be completed. It gives the company a very cheap output on the machines. This also applies to the other departments, and I find when the boys go through the school they take a greater interest in their work, and the instructor aids them in reading the work.

J. F. DeVoy (C. M. & St. P.): It has never been my opinion that it is absolutely necessary for a special apprentice trainer to be put in charge of the apprentices. I would rather a boy of mine went to the foundry foreman for his knowledge in foundry practice, and meet the pattern maker after he went into the pattern shop. I am emphatic in saying one thing—that any apprentice boy will do much better in the drawing room if put there and given three months' time, from start to finish, than if given, say, one hour a day over a longer period.

The committee has suggested that the association provide an appropriation for establishing an exhibit of apprentice training, to be a feature of this convention, and at the same time it has been recommended by different members that the railroad companies stand the expense of the training in place of night classes. Why not, then, have the railroad companies stand the expense of providing the exhibition, it will interest them much more.

J. H. Manning (D. & H.): I agree with the last speaker to the extent that I believe it is impossible to get any instructor who will be able to take any apprentice through all the ramifications of the different trades, but I believe that in combination with the instructor who is capable of instructing the apprentice in mathematics, drawing, etc., there should also be an instructor in the shop. We have an instructor who goes from shop to shop and gives the apprentices instruction two hours a day in the morning. We also have two demonstrators in the shop, and they not only demonstrate and speed up machines for the journeymen, but also give their special attention to the apprentices to see that they are moved along as they deserve. We have a report made showing the percentage of efficiency each month, and we keep close watch on it, and we are well satisfied with what we have done.

Angus Sinclair: I think in the training of the apprentices the same principle holds as in the training of ordinary students. Some men have natural talents for instruction—others have not. One who has the natural faculty for imparting information will be of much greater value in the instruction of apprentices than one who has not, and I think that it ought to be the business of the shop superintendent, and those who are supervising the system, to see that the instructors are proper instructors—that have the capacity for giving the information desired.

I had a very curious experience in securing instruction as a lad in a shop. Where I worked as a boy the boys were just thrown into the shop and allowed to do as they pleased, pretty much anything, so long as the foreman did not see them idling. That was the thing to look out for, but so far as getting any special instruction it was entirely out of the question. If you desired to learn you would probably get the opportunity from some good natured mechanic, otherwise you would learn nothing. I have always felt under a great debt of obligation to a boiler maker I worked with for a few months when I went into the shops as an apprentice.

This boiler maker's name was Willie Lawrie. He was known to be very hard with his boys. After we had been working in the firebox for some hours—this was my first experience—when we went outside so that I couldn't look in, he said, "How many grate bars had that engine?" I said, "I don't know how many grate bars it had, I didn't count them." "Well, but you were inside. How many were there?" and he insisted that I should make some kind of a guess as to how many bars there were. Then he laughed and made fun of me when I was far from being correct. About the next time he would ask, "How many tubes were there in that boiler," Then, "How may stay bolts?" "What is a stay bolt?" "What is it for?" and so on. The effect of this was that I was in a constant fever lest he should be asking something that I didn't know, and I used to prowl around the boilers trying to pick up information about the thing so that I would be prepared for Willie Lawrie. That was a natural teacher. Those who have that kind of ability will bring an apprentice on much better than one who is thrown up just by the chances of the shop.

A. E. Manchester (C. M. & St. P.): In training apprentices we have tried to keep as far as possible from the hot house product. We carry the usual ratio of apprentices, not only at the shops but at the roundhouses. For practical railroad work the roundhouse is the principal and most important place. By giving the boy an opportunity in all of the different branches of the work in all of the different shops, in the manufacturing end as well as in the maintenance end, we believe that we are bringing forth some men capable of holding their own in every line of business, and we believe that within the last ten years, since we have been working this system, we have drawn out some boys who can design and manufacture and maintain anything that is used on a railroad. We believe in the principle, "Seek and ye shall find; ask and ye shall receive; knock and it shall be opened unto you." I would not disparage any system that gives the young man an opportunity, but I still believe, as has been expressed by some of the other speakers, that it is better to let the young man do some of the pushing for himself. We find little or no difficulty in getting all the good material we can use, and more. In nearly every department there is such a long waiting list. When I first started preparing apprentices for the boilermaker's trade, I did so with a good deal of misgiving. You may imagine my surprise when the first set of examination papers was brought in by Mr. DeVoy, the first lot of boys we put into the boiler shop had a standing something like 93.

C. H. Quereau (N. Y. C. & H. R.): All men are educated either through their own efforts or through opportunities given them. There are lots of young men, who are bright, who have not had the opportunity of thinking for themselves. If they are invited, perhaps urged, perhaps commanded, to take a course of study the result will be of benefit, not simply to them but the whole organization. I had the good fortune to be in charge of some shops for two or three years with about 400 apprentices. I believe the conditions there were not exceptional at that time.

There was nominally a record of all those boys and a schedule which they were to follow. The facts, however, on investigation, did not coincide at all with the schedule. There were young men who had been three years in the erecting shop who were supposed to be finished machinists when they came out. There were boys who had been 18 months on a certain machine because the sub foreman was being pushed to complete his output. This boy was an adept at this tool and the consequence was he stayed there; we all know how that is.

The superintendent of shops had not the time personally to supervise the training of each of those 400 apprentices. The result was confusion worse confounded. The result was a class of half-baked machinists when the job was done. I believe at that time these facts were paralleled in almost all shops of the same size.

I am thoroughly in sympathy with the outline of the apprentice work given by this committee, and I wish to subscribe to every one of the suggestions given. The most important point is that there is some one in charge of these apprentices who has nothing else to do. He will be judged by the results he produces. Under the old system that was an impossibility. The superintendent of shops, the foreman, etc., were judged only by the work that was turned out and by the cost, overlooking the most important part of the shop, which was the machinist which was to come. I very much doubt if we should figure on the cost of output of apprentices under this system. It is not the idea of this committee that the apprenticeship cost should reduce the cost of the labor producing efforts of the apprentice. It is to produce first class machinists, and while the cost of this work is a consideration, it seems to me it should be one of the very minor considerations, and not worth emphasis at all. A very live influence under this system is the personal touch of the company through its responsible men, with the apprentices. There is a personal relationship, the value of which cannot be counted; and I believe that in the years to come, if not already, the relations between the company and the men will be found to be much more harmonious than they have been under the older methods and systems. I believe they are beginning to feel and will more and more feel that they are a part of the company—that it is not a separate organization up aloft directing the work below, producing the largest output for the least cost, but that there is a community of feeling which is bound to tell all along the line—and the influence of this association, the influence of this personal contact must be for the best of the men.

E. A. Miller (N. Y. C. & St. L. H.): In 1892 and 1893 we were discussing the disposition of the apprentice when he was through his time. In 1901 and 1902, the question was what we should do to hold our apprentices in the shops and increase the number of apprentices. We lost half the apprentices that we had in the second, third and fourth years, especially the third-year apprentices. We are now at a time when there is no trouble in keeping the apprentices, showing that the number of apprentices in the shops, and the ratio of apprentices to mechanics will be governed very largely by the conditions under which we are working.

I heartily agree with the committee that there should be some one in charge of the apprentices to look after their in-

terests and to see that they have the proper instruction and the proper opportunity to advance themselves.

We have another condition that is to a certain extent against the apprentices. Take, for instance, shops where the unions prevail, and they say when an apprentice is out of his time he must receice full journeyman's wages. There isn't the incentive in many cases, for apprentices to improve themselves as they would were it not for this condition.

The important matter to start with is to get the right boy and the right place; the next matter is to give him a fair opportunity and then it is for him. And whether he has the technical education or the advantages of the better school education, in all probability he will come out successful.

S. M. Vauclain (Baldwin Locomotive Works): For many years we undertook to train our apprentices in the ordinary old style fashion, simply taking them into the works and allowing the foreman to supervise their instruction, and moving them about as their work in any department warranted. We found it necessary to remove the apprentice boy from under the supervision of the foreman and place him under the charge of the superintendent of apprentices. We have had a system of that sort in practice for about seven years and it has been highly beneficial to us. We now do not need to consider going outside to hire skilled men, as we make more skilled men than we can find places for, and these men are eagerly sought by outsiders.

So far as the training of boys is concerned, we believe there is room for all classes and have three systems of apprenticeship. One system requires the boy to serve four years, and is for the boy who probably has gone through the grammar school and is unable to go any further. The next class comprises the boy from the high schools or preparatory schools whose parents have not the means to send him to college and feel that he should learn a trade which will enable him to make a decent living. These boys make a very desirable class of apprentices. The third class of apprentices comprises the technical graduate. The technical boy is the most desirable and there is room for a great many of them as apprentices, but not room for so many of them after they get through with their apprenticeship. Their attainments and ability are such that they are quickly called to higher places than that of an ordinary mechanic. It is desirable, however, to have as many of these technical graduate apprentices as you can persuade to come with you. It is unwise, however, to offer them or hold out to them special inducements to bring them to you for fear that they may be disappointed. I have made it a rule for the first six months to compensate a technical boy sufficiently only to pay his board and a few minor living expenses. If he has the necessary nerve to work for six months under those conditions, we are ready to go on with him, and he is also very glad to keep on with us. The technical boy who comes to us need not necessarily be a graduate. The very finest men we get from the various universities are those we have to use on the finer work, and we do not care to wrestle with the coarser grade of men.

B. P. Flory (Cent. of N. J.): The school in connection with the Central R. R. of New Jersey has been established for about three years. We have been following the same line as some of the other railroads and our ideas are embodied as part of this report. We are very well satisfied with the progress which we have made during that time and see no reason to make any change. We have our school in the day time and believe that is the only time to have the school. There may be some local conditions on other roads which would make it better to have a night school, but on our road, where our large shop is located at a point which makes it necessary for nearly all the boys to live in another town, it would be absolutely impossible to have evening classes.

G. M. Basford (American Locomotive Company): We cannot fail to be impressed by the way in which this new apprenticeship system has gone across this continent in two jumps. It is now likely to go north and south. Its impetus is altogether too great to be stopped. The report says: "It has often been said that apprenticeship is a thing of the past." Apprenticeship is a thing of the past as the word apprenticeship is generally understood today. It is a good thing that it is a thing of the past. What we should do today is to apply some of the principles of instruction which obtained in the old days.

I would like to speak of what seems to be a misconception in the report of the committee on the matter of instruction. The committee has not, as I understand it, the remotest idea of suggesting that instructors should teach all trades. What the committee means is that the chief instructor should make it his business to see that the trades are taught which is not now the case. This matter of instruction reaches the heart of shop practice. What we require to be taught is shop methods, not the old shop methods, but better shop methods. It has been said that the foreman can do this. With all respect to the foreman, I may say that it is the foreman himself who needs instruction in many cases; at any rate, it is the foreman of the future whom we have to instruct. The apprentice instructor needs a strong backing. He needs to have an active part in the management of the shops. He needs to be the right hand man of the shop superintendent, because he is directly the man upon whom the shop superintendent is soon to rely for the best work he can produce. It will require eight or ten years to work it out and see the results, but sooner or later the man who has charge of instructing apprentices will be the most important member of the mechanical organization of a railroad. It will devolve upon him to teach improved shop methods and to find the best way.

It is not going to be so easy to get these men. That is one of the greatest difficulties today, because you want not only a man who can do as well as you are doing, but you want a man who can reach out and know the best work that is being done anywhere in the country, and who can apply that system in your work and teach it to the organization in your shops.

There is another side to this question of the shop instructor. He needs to be one who stands in such close relationship to the boys that they will come to him as a friend in their troubles. In that way he will gain influence over the future organization, the value of which cannot be estimated.

I would refer to several of the principles set forth in the report: "Suitable records should be kept of the work and standing of apperntices." This is very easy to say but very difficult to do.

"Certificates or diplomas should be awarded to those successfully completing the apprentice course. The entire scheme should be planned and administered to give these diplomas the highest possible value." Some of us know the value of diplomas issued by some of the old manufacturing establishments which have had apprentices for the last 30 or 40 years. Such apprentices have no difficulty in securing work, and a diploma of such establishment means something.

"Interest in the scheme must begin at the top, and it must be enthusiastically supported by the management." It must be backed by broadminded enthusiastic support. There is no other way. The subject is really worthy of that.

"Organizations should be such as graduated apprentices can afford to enter for their life work." I think it is especially important that the spirit of that paragraph should be carefully conserved and carried out.

J. F. Deems (N. Y. C. & H. R.): At the recent conference of governors in Washington the point was made that year by year the soil in the West produced less and less and less, and it was said "If you are going to get something out of that soil you have got to put something into it." I feel the same is true in the matter of railroading. If we are to go on and progress as we should, we must give these young men a better opportunity to qualify themselves to fill positions which will be open to them. That will make better men of them and that in turn will make better communities, and better communities will be better for the railroads.

Mr. Vaughan: I move that the committee be congratulated on the excellent report and principles recommended by it; and that the report be adopted and that the principles recommended by the committee be endorsed by this association as recommended practice and substituted for the "Code of Apprenticeship Rules" Adopted in 1898. (The motion was carried.)

The Secretary: The following resolution was adopted last evening at the meeting of the executive committee:

"Whereas, A sub-committee of the American Railway Association has made certain recommendations looking to the co-ordination of the work of the voluntary railway associations with that of its own, be it

"Resolved: That the president of this association be empowered to appoint a committee from its officers to confer with the American Railway Association when requested." On motion this resolution was adopted.

The report of the committee on "Superheating" was next presented by H. H. Vaughan (Can. Pac.) who after reading the report said:

In passenger service, I wish to modify the figures in Table 3, in which the G-2 engine superheaters are shown as having burned 66 and 64 per cent respectively of the coal used by the simple engines. We find that the simple engines have been used on lighter trains and faster trains than the superheaters on an average, and I consider that a good deal of the saving is due to that fact. I do consider that the figures for the E-59 and G-2 engines, on the first four lines of the G-2 engines, showing a saving of 21 and 22½ per cent, are as accurate as we could get them from our road records.

It is a very general thing for devices that show a substantial saving on the test plant not to show the same saving

when applied on the road. Our figures for these six months, which I really consider are figures that we get right along, show a greater saving on the road than the test plant figures have shown, and I must confess that I do not understand it, unless it is that the superheater engines are as a general thing preferred by the men running them and receive a little better attention or they get men on them steadier. I can see no other reason for that. To save 21 to 22 per cent in regular service, coal chute figures, must mean a saving of 30 per cent at least while the engine is running, considering the coal shoveled into an engine before it starts and other features.

Outside of the German figures which have been given by Messrs. Harvey and Schmidt, and which I have always regarded as exaggerated, we have no experimental data to confirm any such saving. At the same time, I conscientiously believe we are getting it, because we have too many engines—we do not keep regular men on the superheater engines any more as we did on the first few engines we got, when we showed 35 per cent saving. That saving was largely gained by the men, but we have today about 70 superheater passenger engines, and running in and out and getting all sorts of crews and men and nobody paying much attention to them any more, with four or five hundred engines in service, there is no talk about the superheater being petted; and our experience is very satisfactory in some ways.

The general manager of our lines West the other day, when I was discussing the advantage of getting some more simple engines with which to make better comparison figures, told me that we could send him compounds or superheaters but he wouldn't have simples any more. He did not relish the idea of building an engine in order to get comparative figures for our information; he was perfectly satisfied we were getting a good saving of coal and he wanted to keep on getting it, instead of spending money for experimental purposes. Eight or nine months ago I was a little in doubt on the superheater question. We were getting into it pretty heavily and were having a good many failures. But the last six months I have felt that we were on the right track. We have got away from our failures pretty well, and I do not think we have had a superheater failure, out of 200 engines, since the end of March. That has been secured by systematic attention in the round house and by periodic tests of the superheater. These things do not cost much money but mean proper attention on the part of the engine man, foreman and others, to see that these things are systematically done.

I have not quoted any costs in this report. We have a lot of costs, but the only figures we could give you would show that a superheater costs less to repair than a simple, and there is no sense in putting up any such figures. There is a certain amount of expense connected with the maintenance of a superheater, but it is very small. The fact that our superheaters are on engines of rather more modern design than the engines built five or six years ago, before adopting superheating, has more than balanced the repair figure. The superheaters, with us, are about as cheap an engine as we have when their weight is taken into account.

Discussion on Superheating.

J. E. Muhlfeld (B. & O.): Mr. Vaughan's experience is especially valuable, but there are a few points which I think very important, and one of those is the degrees of superheat we can use with economy, and also whether we can afford to use the products of combustion, or the waste gases or a combination of the two to produce superheat. The committee has given us some good information and is in a position to carry on its investigations in a very thorough manner.

Wm. Forsyth (Railroad Age Gazette): Mr. Muhlfeld has brought up the question of economy of highly heated steam, and as I understand it, that has been thoroughly threshed out in Germany. They there favor highly suerheated steam and secure a good economy with it; and further, the whole theoretical consideration of this subject in regard to temperature was fully treated in reports to this association by Mr. Vaughan in former years.

Mr. Muhlfeld: I think, in view of the necessity for reducing transportation expenses, that the fuel question is very important, and we would like to have some data on actual performance in this country, and not under the conditions that obtain in foreign countries. I think it is very important to get something to show how far we should go in the use of the live products of combustion, or whether we should confine ourselves to the waste products, or make a combination of the two, in order to obtain a degree of superheat which from the standpoint of maintenance will give us the best efficiency. There is no question about superheat increasing efficiency, but how far should we go with it? Some advocate 50 degrees, some 100 and others 150.

A. W. Gibbs (P. R. R.): I would like to ask the committee whether it has ever observed any gradual change in the dimensions of iron castings exposed to superheat. We have noticed that the fittings in power house plants where we have superheated steam, have increased very materially in dimensions—some as much as 3 per cent. I was wondering whether you had this to face in the cylinders of the engines. I think anybody that has ever handled any of the White steamers, will recall that you may have very high steam and yet the engine is comparatively sluggish. We want to have superheated steam locomotives introduced in passenger service. How are we going to get such results as we have with the White system? I would like to hear about that warping, because we have an investigation on hand now—as to the chemistry of the the iron in effecting the expansion.

Mr. Vaughan: In my paper in 1905, I went very thoroughly into the question raised by Mr. Muhlfeld, and I submitted a proof then that while unused heat was rejected it was more economical to reject that heat than to be without it. In the same way, assuming a certain number of expansions, with a boiler pressure of 100 pounds no more heat is rejected than necessary. Still it is more economical to raise the boiler pressure to 200 pounds and reject the steam at 140 than it is to use it at 100 pounds and reject it at atmospheric pressure.

Some years ago, with another gentleman, I prepared a report which clearly demonstrated that even though heat is wasted it is in the nature of unavoidable waste, and it is still more economical to start with higher superheat than with lower. I was convinced that we need not be afraid of rejecting superheat in the exhaust. I divided our gain from superheat into two items. The first was the reduction of cylinder condensation. You still retained increase due to volume, and there is no further gain to be made from that source. If you will look into that paper you will find the question was taken up carefully. As far as superheat goes in practice we have had engines that gave us from 20 to 30 degrees of superheat and we pulled the heaters out of them because there was not enough benefit to worry about. At first there was a benefit but after the tubes became coated from the soot I did not consider that there was enough benefit to warrant our continuing the use of low superheat. We use freight service now from 100 to 150 degrees of superheat and our regular engine, I think is a 66-inch front end, with 22 tubes, or with 24 tubes, giving us 88 or 96 superheating pipes. Now, my opinion is that the 22 tubes are slightly superior to the 24. I believe that if all these tubes were kept properly cleaned out we would get better service from the 24, but there is a little too much evaporating surface cut out, and I rather prefer the 22-tube type engine. We have 100 engines of each sort, and have watched them, but I cannot tell which type is the more economical. I do not wish to take any position against the Baldwin superheater, but I think the Germans have been on the right track in going to high superheat.

I have had no trouble with warping. We have never measured our castings for it. Our engine was an ordinary plain American simple engine, and we do not need to change it at all.

Mr. Forsyth: Mr. Vaughan has explained to us the advantage of high temperature in superheating so far as the coal economy is concerned. I think the report gives tests showing the advantages of the superheater in bad water districts.

Mr. Vauclain: I am glad to hear Mr. Vaughan says he does not take much stock in low superheat as used by the Baldwin superheater. I have no doubt that he will be glad to know that I do not take much stock in the high superheat. The honors are equal and no harm is done. For twelve or thirteen years I have been interested in superheaters. I have a friend on the other side of the water, Herr Gerber, who is an ardent advocate of highly superheated steam, and he has wanted to sell outright to the Baldwin Locomotive Works all the patents that Mr. Schmidt has or will have on the smoke tube or highly superheated steam appliances. I have always felt that highly superheated steam was not what we wanted in this country, but that we wanted steam superheated sufficiently to overcome all the loss of the single expansion locomotive, and at the same time enable us to go back to a normal boiler pressure of 160 pounds. If we could do this, we would overcome the need for the compound locomotive, and for any special appliance or special metal in the construction of our locomotives for the highly superheated steam. We could thus produce a locomotive that would require even less attention than is now accorded the single expansion locomotive. I felt that if we could obtain anywhere from 400 to 700 feet of heating surface in a smoke box superheater (that could be applied to any locomotive existing without any boiler alterations) in lieu of the ordinary cast iron steam pipe, we could get enough superheat, and at the same time give the average American

railway a machine that could come in and go out every day in the week without any attention and make the maximum number of train miles per month. After considerable persuasion, Mr. Kendrick, of the Sante Fe, allowed me to try the experiment on him. We were building a large number of tandem compound locomotives and I persuaded him to allow me to build a smoke box superheater, sending with the engine all the parts necessary to complete it as a tandem compound locomotive. We put the high pressure cylinders in the tender—a very good place for them—took out the cast iron steam pipes and put in a smoke box superheater to replace them. We coupled the steam pipes to the valve which is on the low pressure cylinder with a cast iron pipe running around in front of the locomotive, and took out the low pressure valve so as to use the engine as a low pressure single expansion locomotive. The cylinder was 32 by 32 inches, and the working pressure was 220 pounds. We reduced it, using the ordinary method of calculation, to 130 pounds. The locomotive went into service and did so well that nobody took the trouble to inquire what might be in the smoke box, but they found that the pressure could gradually be increased and it was increased until finally the locomotive carried 160 pounds. I have in my office a record of this engine which has only 237,000 pounds on drivers giving a draw bar pull continuously of 68,000 pounds working on sand. The same thing found on this locomotive was found in Germany, but in order to get the very best results from superheated steam, very large cylinders must be used in proportion to the weight on the drivers, so that a greater number of expansions can be obtained than is ordinarily considered desirable in single expansion engines, and personally I care to do nothing further in the way of superheat. I prefer to let this one engine solve the problem as to whether there really was any advantage in low superheated steam; there evidently has been, because we have been called upon to build a very large number of these smoke box superheaters, not only for the Sante Fe, on which we tried the experiment, but for other roads.

I also had in view when this locomotive was built the determination of whether such an engine would be as economical in road service as the best compound engine that we were building, and we have had it proved to us—we have not proven it to anybody else—but we have it proved to us most clearly that we can obtain the same economy from a low superheated steam at a boiler pressure of 160 pounds, as we can with compound locomotives carrying 220 pounds. In addition we obtain anywhere from 30 to 50 per cent additional engine miles in a given time. There is less to get out of order about a locomotive of this kind than there is about any single expansion locomotive carrying high pressure steam or any compound locomotive carrying low pressure steam.

O. M. Foster (L. S. & M. S.): Our experience on the Lake Shore with the superheater has been rather limited, but at the same time we are in favor of the superheater. Our use of it has been restricted to two out of 46 passenger engines. The application of the superheater to these two engines immediately put them in a class by themselves so far as performance was concerned. It became our practice to use these two engines for the hardest passenger service to which this class of engine was assigned. They handled a train better, they made better time, or they handled a bigger train more successfully. We never made any careful test to find out as to the comparative economy of the two engines. In a rough way, however, we think, and our engineers all agree with us, that they show an economy of 15 or 20 per cent in fuel and water, and this with an increased efficiency in the handling of traffic. Our engineers believe so thoroughly in the superheat that it is quite common to have them say that they would like to see a superheater put on our later class of passenger engines. It has been decided to apply superheaters to some of our first class passenger engines.

I believe we need not fear what may result in the way of additional cost for maintenance or of delays in service.

W. C. Squire: I believe there is a motion before the house made by Mr. Muhlfeld and seconded by myself.

The Secretary: The motion was that the committee be continued and requested to give us more information pertaining to the use of the live products or waste products of combustion.

Mr. Muhlfeld: Mr. President, I think from the discussion we have had here there seems to be some question as to the limits of superheating. The committee has done a great deal of good work and I think we should get the benefit of its further investigations. I would appreciate very much having that committee continued.

The motion was carried.

C. A. Seley (C. R. I. & P.): The chairman of the "Apprenticeship System" committee could I think present an interesting discussion closing that which ensued after he presented the report. I move that he be offered the opportunity of presenting that in writing for the proceedings. (Mr. Seley's motion was seconded and carried.)

The report of the committee on "Mallet Articulated Compound Steam Locomotives" was then presented by J. E. Muhlfeld (B. & O.), chairman of the committee.

Discussion on Mallet Compounds.

Upon completing the reading of the report, Mr. Muhlfeld said:

In the past two or three years you have probably read in the magazines and the technical journals, and papers presented before railroad clubs, a considerable number of reports on the subject of electrification, which go further than the motor car service and go into the electric locomotive service. I think from the electrification that has been made so far, and which applies to electric locomotives and not motor cars, that our electrical colleagues have found that it necessitates more than the application of an armature and some fields around a driver wheel and axle.

The electrification, however, of the steam railroads, especially where the city terminal features and the tunnel conditions and other features are involved, is something that will be given more and more consideration each year, and I think, therefore, that in steam locomotive design the use of higher steam pressures, combined with or independent of superheating, the use of heaters for feed water, the use of compound cylinders and greater efficiency of the boiler should be given serious consideration.

There is no doubt that the locomotive boiler and the locomotive engine is uneconomical; at the same time, an outside source of power is expensive. But while the steam locomotive compares favorably with the electric at the present time, unless we decrease the cost of operation by decreasing fuel consumption and increasing the capacity, the electric locomotive will prove a competitor later, especially where water power is available. Those who are the most enthusiastic about electrification are those who design and install electric systems. Up to the present I have not heard anything very favorable from those who maintain and operate the electrical equipment, and they are to be the real judges of the efficiency of the electrical system; we understand from them that it has been very expensive.

S. M. Vauclain (Baldwin Locomotive Works): Mr. Muhlfeld claims that one advantage of a Mallet boiler is the larger engine, the opportunity to get on so much larger boiler. I think those who have the Mallet design find that there is considerable difficulty to get the large boiler and keep the weight down to the limit per driving axle. You will notice on the smaller type locomotives which we build for the Great Northern that the boiler on this locomotive is the same size exactly as the boiler on their company's Pacific type passenger engine, so that with a locomotive with 50 per cent. more weight on the drivers we have virtually the same boiler, but the high efficiency which we are able to obtain from this engine makes this boiler sufficiently large for the maximum capacity desired for the work to be performed. With the use of trucks front and back on the Mallet locomotive we are able to get additional boiler capacity, and I am in favor of a leading and trailing truck for the larger types of Mallet engine on that account.

Mr. Muhlfeld also called attention to the opportunity for intermediate superheat and that is a matter that is not only being considered tentatively but is absolutely being designed and will be put into service very shortly. I wish to call attention to what I think is a very bad feature in this report, and that is the record of the dry steam consumption of the Mallet engine on the Erie railroad. I do not like to see it, because I do not think it is true. I do not believe that any Mallet type of compound engine will use as high as 37 pounds of dry steam per indicated horsepower, or 42.4 pounds of dry steam per dynamometer horsepower. It will not do that unless there is a straight line connection between the high pressure steam pipe and the smoke stack, and my idea is that the engineer may have been afraid of his water in these trials or the gage cock may have been open entirely too high for the grade and that considerable solid water flowed over, and those making the tests failed to take account of the solid water—while they may have taken account of some of the moisture in the steam, because I do not believe that steam with only 2 per cent of moisture in it would give any such results in a Mallet compound as 40 pounds of dry steam per dynamometer horsepower. My opinion is that it had a 20-pound water rate, at least not over that.

It has been definitely demonstrated that these Mallet engines are not so well adapted to the mountain pusher service as they are to low grade freight service and while they are highly economical in mountain service they are most economi-

cal on low grade service and are being put to work on grades as low as 6-10 of 1 per cent and are being considered by a road which has only a grade of 2-10 of 1 per cent.

C. J. Mellin (American Locomotive Works): In reference to the test made on the Erie, the young men came from Cornell University and made the arrangement with the road to make that test without there being any time for necessary adjustment, even of the more important parts, after six months in service. They had just reduced the number of firemen from two to one, and it appeared that the fireman objected very much to this and the engine did not steam satisfactorily; it stalled on the test trip in the middle of the grade on account of shortness of steam, and then stood off nearly half an hour before it got up steam. That would require a great deal of fuel and water, and consequently there have been shown high figures on water consumption. The superintendent told me he had made a comparison for several months, and that the engine did not take more than 18 per cent more fuel than one of the three other engines that it had replaced. That means that the saving in coal consumption over this period amounted to over 60 per cent. He called attention to the leaky condition of the engine, and said that the engines should have been gone over before tested. He said that these engines had done much splendid service that they had not found it necessary to give the engines any particular attention since they came on the road, and had had no time to make any preparation for the test.

In regard to the front and rear truck, that Mr. Vauclain advocates I am not entirely of that opinion, for I find that we get a better engine, going ahead as well as going back, without trucks, because the trucks elongate the leverages and the front truck is certainly a great objection when an engine of this kind is backing, and the rear truck would not be necessary. We are building now an engine with only a front truck, and we are building it under protest, for if we go forward the truck is doing no harm and it does not do any particular good; but in going back it is a serious matter to have an engine with a front truck. I would not advise backing very fast with an engine that has to overcome the resistance of the front truck.

Mr. Muhlfeld: I move that the committee's report be accepted as describing the progress that has been made to the present time with the Mallet type of locomotive, which covers about one hundred of that type of locomotive on the principal railroads. I think it is about all the data we have at the present time. (The motion was carried.)

A. W. Gibbs' paper on "Tests of Briquetted Coal" was then presented in abstract by Mr. Nelson.

Discussion on Briquet Fuel.

After reading the paper Mr. Nelson continued:

Since I have gone into the locomotive testing plant business we have stopped talking about whether a locomotive is a good steamer or a bad steamer, and we measure it now by saying that it will evaporate so many pounds of water per square foot of heating surface per hour. With gas coals we have obtained as a maximum nearly 18 pounds, and probably in road service we get about 12 pounds of water per square foot of heating surface. I noticed just now in connection with the discussion of the report on Mallet compounds, that the boiler on the Erie locomotive evaporated an equivalent of about 9 pounds of water, so that this figure mentioned in this report of 19 pounds is very remarkable.

Recently we have exposed the briquets to the weather. They seem to deteriorate in spots. You will find here and there some briquets which are going to pieces, and those which are close to them are still very hard and good for years.

W. H. V. Rosing (Mo. Pac.): From the experience we have had with coal in briquet form, I find that the success of coal in that form, as compared to coal of like character in other forms, depends largely on the pressure with which the briquet is made. We made numerous experiments with briquets made by the geological survey, the one kind being square, rather large, and necessitating breaking before firing. We found that in breaking the briquets we had about 12 per cent of slack. Later, machines were introduced and briquets made weighing about one-half pound each. These briquets gave fully as good results in actual practice as the report here indicates. Later tests made show that briquets made from any class of coal, either bituminous or the semi-anthracite, of Arkansas, which runs from 76 to 80 per cent carbon, gave proportionately the same results as compared to other fuel. The question of briquetting is one of considerable importance, especially to the Missouri and Arkansas mines on account of the large percentage of slack used in mining. The Arkansas mines run from 50 to 55 per cent of slack, and they cannot always find a market for their product. One of the particular things in the burning of any briquet I noticed that the briquet was consumed from the outside.

Comparing the briquet with lump coal in the fire box, the gases emitted from the lump coal seem to come out in a parallel plane so to speak with the veins of the coal and would not mix with the air, while with the briquet which is a homegeneous mass, the gases seem to come out from all sides of the briquet, and mix with the air as they passed by and through the fire. We found in all cases that smoke was reduced 50 per cent as compared with lump coal of the same grade. The Missouri Pacific finds it desirable to store considerable quantities of coal during certain seasons of the year. We have more or less trouble from spontaneous combustion in these coal piles. Last year we lost about eight per cent from this cause. We feel safe in storing briquetted coal for an indefinite period.

We have some briquetted coal, several tons, piled in the open air which has now been there for more than three years and it shows scarcely any change. If the briquets are made hard enough, with a sufficient amount of pressure, I doubt if there will be any trouble whatever from that source. In making our tests with the briquet coal we unloaded the coal chute and dumped it on the tender in the usual way, to see what the breaking up would be. We found that it was little or nothing if the briquet was made at high pressure. We also found that they could use a little less binder with the higher pressure, although we did not find any difference in the binders used, which varied only five to eight per cent.

The smokelessness of the briquet coal, I understand, is now receiving considerable attention from the navy department, and I think some 1,200 tons was tested on the flagship before the recent trip around the Horn. It seems to me that the question of reducing the amount of smoke in the immense funnels on a battleship is of more importance than economy in fuel consumption, because the boilers are all of sufficient size to take care of their requirements.

J. F. DeVoy (C. M. & St. P.): Has any attempt been made to briquet Montana coal, and, if so, what constitutes the method and what is the cost? It has become a very serious problem with us to handle Montana coal on account of its ability to burn up the country.

Wm. Forsyth (Railroad Age Gazette): Some years ago Mr. Rhodes had charge of an investigation of that kind, and he had some of that Montana lignite shipped to some briquet plant. The results obtained were given in the form of a report to the motive power department of the Burlington, and the figures can be obtained there I have no doubt. As I remember it, the cost of briquetting was rather high and almost prohibitive. I think that is the case generally.

Mr. Egbert: I have not heard of any of the Montana lignite coals being briquetted, but we have taken samples of the North Dakota coal and briquetted them very satisfactorily. The cost of manufacture depends upon the coal. Ordinary lignite will run about $1.00 per ton for the cost of briquetting. The semi-lignite coals can all be prepared; but it all depends upon the quality of the coal and the amount of binder used. The disintegration in storage depends on the binder used—whether it is water and weather proof. The ordinary pitch makes a good binder. Other binders will have the effect of the disintegrating of which Mr. Nelson speaks.

Mr. Manchester: What I had specially in mind was that property or peculiarity of lignite coal to spark and fly off and stay alive. Does briquetting destroy that property?

Mr. Egbert: Yes. The briquet will lie in the fire compactly and will burn evenly from the outside and there will be no discharge of sparks.

Mr. Rosing: In observing the cinders from briquet coal we find that it throws very much less cinders than does screened lump coal, and I would say, in a general way, that the throwing of cinders is reduced to about the same extent as the reduction in smoke. I have no figures on the cost of the briquetting of coal, but in figuring it up some time ago with some of the officials of the geological survey, we found that the binder was one of the great items. The least we could buy a binder for was $10 a ton. We did get some of it at $9.00. To make a comparison of the efficiency of the lump coal with briquets of the same material, rating our lump coal on the tender at $1.70, we made a report that we could afford to pay $2.23 for the same coal briquetted on the evaporated basis.

L. R. Pomeroy (Safety Car Heating & Lighting Company): You will notice that all tests were based upon 2,320 square feet of heating surface, which is the heating surface at the fire side of the tubes, and inasmuch as some comparison has been made with the evaporation of the Mallet compound report, which is based on an equivalent heating surface at the outside of the tubes, I would like to request before the paper goes into the proceedings that it also state the evaporation in the form in which most of our statistics are presented to the association. For example, the report says, "the lowest rate of evaporation was about 18,000 pounds of water per hour, equal to 8 pounds per square foot of heating surface."

Now, on the basis of the heating surface as we usually treat it, that would become 7 pounds. Later it says, "this is equivalent to 19 pounds of water per hour." Now, under our usual basis of heating surface, as the report referred to on the Mallet compound, that would become 16.75. If we are comparing engines with heating surfaces computed in one case on the fire side and in the other on the water side, we may get some discrepancies.

Mr. Nelson: That addition could be very easily made. The reason we have taken the fire side of the tubes is because the advisory committee in connection with the St. Louis test, three of the members of which were appointed from this association, decided that that was the proper basis of measuring the heating surface, and we have followed it ever since, although in most of our reports we have taken both.

A. W. Gibbs: There is one improvement in briquets that I think should receive attention. The character of the cinders thrown from the briquets is annoying. When you examine them, they appear to be in the form of little saucers of coal. We were for some time at a loss to know what that was due to. Apparently it was because the briquette is a regular gas generator. You put it on the fire and it burns on the surface into a coke, and the gas coming out drives that little scab of coke off. It is a very thin layer, but it is free and so light that it goes off. Our measurements seem to show as much driven off in this way as in the case of the coal. Now, it occurred to me some time ago that if we could perforate our briquets something in the way that crackers are perforated, to let the gas off, without driving the surface scab off, we could burn the whole thing in place. I am hoping to see some experiments made in which this thing is perforated to allow of the liberation of gas without this cinder. As it stands now, I think it would be a very objectionable thing in a crowded community to work an engine hard that was burning briquets, on account of the lightness of these little scabs and the distance that the wind would carry them.

Mr. Egbert: That can only be avoided by increasing the density of the briquets. The pressure that is used reduces the amount of binder that is put in, and the more the pressure, the denser the briquet, and the less binder is necessary.

H. H. Vaughan (Can. Pac.): I move that the introduction of the topical discussions to be opened by D. J. Reading, and R. D. Smith be presented to the secretary in written form, and included in the proceedings, and that those subjects be dropped. (Carried.)

Adjourned.

AMONG THE EXHIBITS.

The Sprague Electric Company's exhibit of steel armored hose is attracting a great deal of attention. A number of standard lengths of air brake and signal hose are shown, and the merits of the steel armor protection, increased flexibility, and the prevention of injury to the inner tube at nipples are made plain. A special feature of the exhibit has been the demonstration of the pressure that the hose will withstand. The company is also displaying steel armored cables and flexible steel conduit for the wiring of cars and car properties.

* * *

The Maryland Railway & Electric Supply Company of Baltimore, is the exclusive southern sales agent for Stewart railway speedometers for private, observation and passenger cars. These operate on the centrifugal principle, the drive being from the road wheel of the car by a direct and positive transmission.

* * *

The weight and design of the Victor No. 2 car replacer are both of great advantage when derailments occur at frogs or switches; they can be placed and spiked very quickly and will handle any size equipment. The U. S. Metal & Manufacturing Company handles this device.

* * *

The Pocket List of Railroad Officials, now in its fourteenth year, affords within itself an interesting showing of the growing appreciation in which it has been and is now held. The first issue covered the first quarter of 1895. It contained altogether 292 pages between the covers. The latest issue—No. 54—consists of 704 pages exclusive of the covers. The first contained the name and address of the officials of 1,010 railroads, or 10,980 names; the latest, 1,315 roads and 18,090 officials. One page with 26 names was sufficient for the list of advertisers; the current issue has a list covering 14 pages with the names of 491 firms, companies or individuals. A modest claim was made that the first issue reached over 11,000 officials; it is said to require more modesty now to limit the claim to 19,000 officials and the publishers guarantee a distribution of not less than 18,000. The scope of the book has not been greatly changed in kind—the addition of the names of officials of express and telegraph companies being the principal new heads—but every department has been greatly improved and rendered more complete. It would be difficult to suggest any extension that would add to the usefulness of the book without at the same time endangering the characteristic indicated by its name—a pocket list.

* * *

The Commonwealth Steel Company is exhibiting at booth 311 a model of its well-known cast steel locomotive pilot beam with a cushion buffing arrangement for switchers. The pocket for the cushion arrangement is made integral with the pilot beam, which greatly strengthens the beam and reduces maintenance expense. The cast steel pilot beam is a great protection to the engine and cylinders in case of wreck or side swipe.

* * *

Eureka Gloss-Kote lacquer on passenger locomotive boiler front-ends will help the appearance of the entire train. The lacquer is applied with a sheep's wool mit, a new method found to be both practical and economical. It rubs up a gloss within a few seconds that remains for several days with an occasional touching up. This lacquer is made by The Otley Manufacturing Company, Chicago.

* * *

The exhibit of the National Lock Washer of Newark, N. J., has attracted much attention. This concern makes a large number of patterns and styles of car curtains, curtain fixtures and window fixtures and the like, as well as nut locks for track, car, bridge, automobile and vehicles of all description, embracing upwards of 300 different sizes and styles.

* * *

L. C. Weyand, general manager of the National Car Seal Company, Chicago, is exhibiting a sample of the Unoit car door fastener and seal which has recently been adopted by the Chicago, Milwaukee & St. Paul and other railroads. Mr. Weyand has been a missionary in the seal business for many years and the success he is now meeting is very gratifying.

* * *

The Noscalon Company, of New York, has on exhibition a device to be connected with feed-water pipe through which may be mixed with the water the salts for the correction of the matters in solution that cause boiler scale. No effort is made to treat the water except at the moment it is being used, to supply the necessary salts, the lack of which cause scale. It is claimed that Noscalon not only prevents scale, but dissolves the scale that may have been formed.

* * *

While they admit that it takes considerable time to tell all the good points of the Anti-Pluvius skylights, the Lovell window operator and the Cibulas ventilating sash operator, the representative at the G. Drouve Company seems to enjoy the work.

* * *

The Buffalo Brake Beam Company has occupied its new plant at Buffalo, N. Y., which it prides itself is the most complete and up-to-date plant for the manufacture of brake beams and brake beam appliances in the country, as the plant is equipped throughout with new and modern machinery.

* * *

Gold's new 2-piece steam hose couplers attracted a great deal of attention during the convention. The fact that different size hose may be used with the same coupler makes this a very convenient arrangement.

CASTLE NUTS.*

Concerning the use of the castle nut on locomotives, your committee can not too strongly recommend its application to every important bolt on the locomotive and tender. Reports from various railroads which have made extensive use of the castle nut on locomotives indicate that a very appreciable reduction in the number of machinery failures is the immediate result obtained.

In deciding on dimensions for the castle nut it was thought advisable to consider two thicknesses for each size of nut. One series for general use and which could be applied in the transition period to bolts already having cotter pins for retaining the U. S. standard finished nuts, will be referred to hereafter in this report as the "castle nut." Another series, which in the larger sizes is considerably less in thickness than the U. S. standard nut, for use in service, such as on the valve motion parts, or other places where there is sufficient clearness to apply a nut of full thickness or where the strain on the bolt is in shear and in consequence there is no direct tension on the nut, will hereafter be referred to as the "thin castle nut."

The Association of Licensed Automobile Manufacturers has already adopted standards for castle nuts, but as their standards have a finer thread than the U. S. standard system for screw threads it was soon found that their standard could not be harmonized with the proportions of the proposed castle nuts for U. S. standard thread.

In deciding on dimensions for castle nuts and thin castle nuts the committee endeavored to follow, as far as practicable, the proportions of the U. S. standard hexagon nut, with the result that the following features common to the U. S. standard hexagon nut can be followed:

The style of nut to be hexagon.

The width across flats, or short diameter of hexagon, to be same as the U. S. standard dimensions already adopted for the finished hexagon nut by the American Railway Master Mechanics' Association. No specific dimensions will be recommended for diameter across flats for rough nuts, other than that these should be practically the same as for finished nuts, simply allowing only sufficient additional material to finish by grinding and buffing.

Threads to be U. S. standard thread and number of threads per inch to be the same as already adopted by the association.

There are, however, a number of large-sized nuts used on the locomotive, which, on account of clearances, their thickness does not permit the use of the standard number of U. S. threads, and with the coarser threads there is a liability of their working loose. To take care of such cases we have shown on Plate No. 4 the number of threads per inch to be used on this class of nuts, which will be known hereafter as the "special thin castle nut."

Number of castle slots, six; cut through center of flats. Sizes of castle nuts and thin castle nuts considered: from one-half inch to two inches advancing by eighths; from two inches to three and one-half inches advancing by quarters.

In designing the castle nut, the first feature for consideration is the size of cotter pin or taper pin to be used. For this we have devised the formula, Diameter $= (D \div 8) + \frac{1}{8}$ inches (where D equals diameter of screw), using the nearest commercial size of cotter pin to the dimension found by the formula.

After deciding the diameter of cotter the castle slot is next considered, and for this there was assumed a tolerance of one thirty-second inch between each side of the cotter pin and the wall of the castle slot. In arriving at the proper depth of slot there was assumed, as sufficient for common practice, a depth three-sixteenth inch greater than the nominal diameter of cotter. The proportions of castle slot thus selected make them susceptible to any method of manufacture.

Obviously the castle nut requires in the bolt or stud and within the castle slot, some form of cotter or pin to prevent the nut from turning on the screw, and means must be provided to insure the proper location of pin hole with relation to depth of castle slot. This feature will be covered by a minimum distance from end of bolt to top of castle nut and another dimension locating the pin hole with reference to end of bolt. Notice that the dimension of cotter pin and castle slot, also dimensions of bolt end and location of cotter pin hole in bolt will be the same for both the castle nut and the thin castle nut.

After deciding on the standard size of cotter pins to be used and then designing the castle slot to correspond, the next step in the design of the nut is to consider its thickness. In doing this we assumed the 1½-inch nut as a starting or generating point. Then for the castle nut ¼-inch is added to the thickness of U. S. standard nut, and for the thin castle nut ¼-inch was deducted. A minimum thickness of ¾-inch for ½-inch castle nut is required to give the proper castle slot proportions for the size of cotter selected. From this conclusion your committee was enabled to devise a straight line formula for the thickness of the castle nut and thin castle nut which would give results corresponding with their conclusions as to the proper thickness for the ½-inch and the 1½-inch sizes. Intermediate thicknesses are obtained from the formula. The thickness of the castle nut increases by increments of ⅛-inch, and the thin castle nut by increments of 1-16-inch for each ⅛-inch step in size of nut to and including the 1½-inch size. These formulæ if applied to the 3½-inch castle nut would give a thickness of 3¾ inches, and if applied to 3½-inch thin castle nut would give a thickness of 2¼ inches. These dimensions were considered as giving a nut entirely too heavy for practical use, and were therefore reduced by ½-inch in thickness, thus making the 3½-inch castle nut 3¼ inches thick, and the thin castle nut 1¾-inch thick. A straight line formula was also devised covering the thickness selected for the 1½-inch and 3½-inch sizes. In these formulæ the thickness of castle nuts above the 1½-inch sizes increases by increments of 3-16-inch, advancing by quarters, and for thin castle nuts the increment of increase is 1-16-inch. These formulæ give, for the 1⅝-inch and 1⅞-inch sizes, a thickness in which a thirty-second dimension is necessary to express, and to avoid this feature the next higher 1-16-inch dimension is used instead of the dimension found by the formula.

Plate No. 4 is a table showing the dimensions for various castle nuts and the thin castle nuts. It also shows the formulæ employed in deciding these dimensions and results obtained from the formulæ. We have eliminated the use of any dimensions in thirty-seconds of an inch, with the exception of the facing collar on bottom of finished nut, which is to be 1-32-inch higher.

The committee wishes to submit for consideration of the association a form of cotter designed by Mr. Player, of this committee, which overcomes some of the objectionable features of the common cotter when applied to the castle nut; one of the advantages being, that when put in place it cannot turn around at will, and in consequence the liability of its rattling loose is diminished. Another advantage is, that a saving in the length of cotter, as compared with the common cotter pin, is effected.

In the table of cotter pins (Plate No. 4) the sizes selected all appear in the manufacturers' standard list of spring cotters. While the practice is not general, some of the railroad companies are using a taper pin in place of cotter for retaining the nut, and for their convenience sizes of taper pins to be used in connection with the castle nut are given. The various sizes and lengths specified are contained in the manufacturers' list for taper pins.

In giving the dimensions for end of bolt it was thought desirable to show proportions of bolt with ends reduced below bottom of thread to present a plain surface for drilling the cotter pin hole. This is not necessary, however, as the same result can be obtained by filing a groove or flat to start the drill. On account of the necessary reduction of thread bearing and its consequent reduction in holding capacity of the nut, reduced bolt end should not be used with the thin castle nut, but instead the thread should be continued to the end of bolt. In preparing the end of bolt, so as to give protection to the thread, notice that the end is shown on the various plates preferably faced off flat for a distance equal to half the diameter of screw. The outer surface of end is chamfered for a distance equal to half the projection of bolt above nut.

Having explained the manner of arriving at the various dimensions of the castle nut and thin castle nut, the committee would make the following recommendations, the dimensions for each of which is given in detail on Plate No. 4:

1. A series of castle nuts having U. S. standard thread with dimensions as shown.

2. A series of thin castle nuts having U. S. standard thread with dimensions as shown.

3. A series of special thin castle nuts having outward proportions the same as thin castle nuts, but having special number of U. S. threads, as shown.

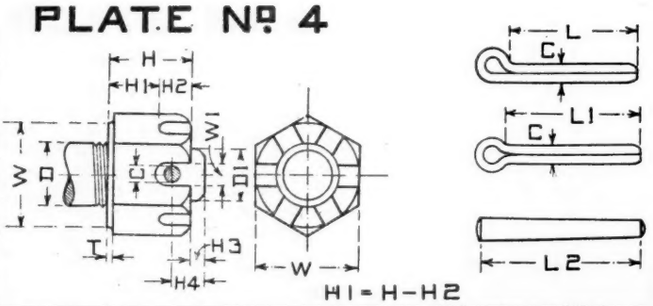
4. Finished castle nuts to have diameter across the flats as shown. Rough nuts to be from 1-64 to 1-32 greater distance across the flats than the finished nuts, to provide for finishing by grinding and buffing.

5. Finished nuts to have facing washer on bottom with dimensions as shown. Rough nuts to have bottom corner slightly chamfered.

6. A series of standard cotter pins with dimensions as shown.

*Abstract of report presented at the annual convention of the American Railway Master Mechanics' Association at Atlantic City, N. J., June, 1908, by a committee consisting of R. B. Kendig, J. F. DeVoy, H. P. Meredith, John Player, J. N. Mowery and G. S. Edmonds.

PLATE No. 4



H1 = H − H2

TABLE OF DIMENSIONS FOR CASTLE NUTS AND THIN CASTLE NUTS

DIMENSIONS GIVEN ARE IN INCHES

RECOMMENDED DIMENSIONS

NUT	D	DIAMETER OF SCREW	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2
		Nº OF THREADS PER INCH U. S. STD. CASTLE AND THIN CASTLE NUT	13	11	10	9	8	7	7	6	6	5 1/2	5	5	4 1/2	4 1/2	4	4	3 1/2	3 1/2	3 1/4
		Nº OF THREADS PER INCH FOR SPECIAL THIN CASTLE NUT	13	11	10	9	8	8	8	8	8	8	8	8	8	8	8	8	8	6	6
	W	DIAMETER ACROSS FLATS OF FINISHED HEX. NUT	13/16	1	1 3/16	1 3/8	1 9/16	1 3/4	1 15/16	2 1/8	2 5/16	2 1/2	2 11/16	2 7/8	3 1/16	3 7/16	3 13/16	4 1/16	4 9/16	4 15/16	5 5/16
	W	DIAMETER OF FACING COLLAR	13/16	1	1 3/16	1 3/8	1 9/16	1 3/4	1 15/16	2 1/8	2 5/16	2 1/2	2 11/16	2 7/8	3 1/16	3 7/16	3 13/16	4 3/16	4 9/16	4 15/16	5 5/16
	T	THICKNESS OF FACING COLLAR	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32	1/32
	H	THICKNESS OF CASTLE NUT – ROUGH	13/16	15/16	1 1/16	1 3/16	1 5/16	1 7/16	1 9/16	1 11/16	1 13/16	1 15/16	2	2 1/8	2 3/16	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8	3 5/16
	H	THICKNESS OF CASTLE NUT – FINISHED	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	1 15/16	2 1/16	2 1/8	2 5/16	2 1/2	2 11/16	2 7/8	3 1/16	3 1/4
	H	THICKNESS OF THIN CASTLE NUT – ROUGH	13/16	7/8	15/16	1	1 1/16	1 1/8	1 3/16	1 1/4	1 5/16	1 3/8	1 3/8	1 7/16	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4	1 13/16
	H	THICKNESS OF THIN CASTLE NUT – FINISHED	3/4	13/16	7/8	15/16	1	1 1/16	1 1/8	1 3/16	1 1/4	1 5/16	1 5/16	1 3/8	1 3/8	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4
		Nº OF SLOTS IN CASTLE	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	W1	WIDTH OF SLOT IN CASTLE	1/4	1/4	1/4	5/16	5/16	5/16	5/16	3/8	3/8	3/8	7/16	7/16	7/16	7/16	7/16	9/16	9/16	9/16	9/16
	H2	DEPTH OF SLOT IN CASTLE	3/8	3/8	3/8	7/16	7/16	7/16	7/16	1/2	1/2	1/2	9/16	9/16	9/16	9/16	9/16	11/16	11/16	11/16	11/16
BOLT	C	DIAMETER OF COTTER PIN HOLE IN BOLT	3/16	3/16	3/16	1/4	1/4	1/4	1/4	5/16	5/16	5/16	3/8	3/8	3/8	3/8	3/8	1/2	1/2	1/2	1/2
	H3	PROJECTION OF BOLT BEYOND TOP OF NUT	3/16	3/16	3/16	3/16	3/16	1/4	1/4	1/4	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16	3/8	3/8	3/8
	D1	DIAMETER OF REDUCED END OF BOLT	3/8	7/16	9/16	11/16	13/16	7/8	1	1 1/8	1 1/4	1 5/16	1 7/16	1 9/16	1 11/16	1 7/8	2 1/8	2 5/16	2 9/16	2 3/4	3
	H2+H3	LENGTH OF REDUCED END OF BOLT	9/16	9/16	9/16	5/8	5/8	11/16	11/16	3/4	3/4	3/4	13/16	13/16	7/8	7/8	7/8	1	1 1/16	1 1/16	1 1/16
	H4	DISTANCE FROM CENTER OF COTTER PIN HOLE TO END OF BOLT	3/8	3/8	3/8	7/16	7/16	1/2	1/2	1/2	1/2	1/2	9/16	9/16	9/16	9/16	9/16	5/8	5/8	5/8	5/8
COTTER	C	NOMINAL DIAMETER OF COTTER PIN	3/16	3/16	3/16	1/4	1/4	1/4	1/4	5/16	5/16	5/16	3/8	3/8	3/8	3/8	3/8	1/2	1/2	1/2	1/2
	L	LENGTH OF PLAYER COTTER PIN	7/8	1	1 1/4	1 1/2	1 1/2	1 3/4	1 3/4	2	2	2	2 1/2	2 1/2	3	3	3 1/2	3 1/2	4	5	5
	L1	LENGTH OF COMMON COTTER PIN	1 1/4	1 1/2	1 1/2	2	2	2 1/4	2 1/4	2 3/4	2 3/4	3	3	3 1/2	3 1/2	4	4	5	5	6	6
TAPER PIN		SIZE OF TAPER PIN WHEN USED INSTEAD OF COTTER	#2	#2	#2	#4	#4	#4	#4	#5	#5	#5	#6	#6	#6	#6	#6	#8	#8	#8	#8
	L2	LENGTH OF TAPER PIN	7/8	1	1 1/4	1 1/2	1 1/2	1 3/4	1 3/4	2	2	2	2 1/2	2 1/2	3	3	3 1/2	3 1/2	4	5	5

DIMENSIONS OBTAINED FROM FORMULAE

FORMULAE																					
D	DIAMETER OF SCREW	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2
$W=\frac{3D}{2}+\frac{1}{16}$	DIAMETER ACROSS FLATS OF FINISHED NUT PLAIN U.S., CASTLE AND THIN CASTLE NUT	13/16	1	1 3/16	1 3/8	1 9/16	1 3/4	1 15/16	2 1/8	2 5/16	2 1/2	2 11/16	2 7/8	3 1/16	3 7/16	3 13/16	4 3/16	4 9/16	4 15/16	5 5/16
$H=D+\frac{5}{16}$	THICKNESS OF CASTLE NUT 1/2" TO 1 1/2" DIAM.-ROUGH	13/16	15/16	1 1/16	1 3/16	1 5/16	1 7/16	1 9/16	1 11/16	1 13/16	—	—	—	—	—	—	—	—	—	—
$H=\frac{3D}{4}+\frac{11}{16}$	THICKNESS OF CASTLE NUT 1 1/2" TO 3 1/2" DIAM.-ROUGH	—	—	—	—	—	—	—	—	1 13/16	1 29/32	2	2 3/32	2 3/16	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8	3 5/16
$H=D+\frac{1}{4}$	THICKNESS OF CASTLE NUT 1/2" TO 1 1/2" DIAM.-FINISHED	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	—	—	—	—	—	—	—	—	—	—
$H=\frac{3D}{4}+\frac{5}{8}$	THICKNESS OF CASTLE NUT 1 1/2" TO 3 1/2" DIAM.- FINISHED	—	—	—	—	—	—	—	—	1 3/4	1 27/32	1 15/16	2 1/32	2 1/8	2 5/16	2 1/2	2 11/16	2 7/8	3 1/16	3 1/4
$H=\frac{D}{2}+\frac{9}{16}$	THICKNESS OF THIN CASTLE NUT 1/2" TO 1 1/2" DIAM.-ROUGH	13/16	7/8	15/16	1	1 1/16	1 1/8	1 3/16	1 1/4	1 5/16	—	—	—	—	—	—	—	—	—	—
$H=\frac{D}{4}+\frac{15}{16}$	THICKNESS OF THIN CASTLE NUT 1 1/2" TO 3 1/2" DIAM.-ROUGH	—	—	—	—	—	—	—	—	1 5/16	1 11/32	1 3/8	1 13/32	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4	1 13/16
$H=\frac{D}{2}+\frac{1}{2}$	THICKNESS OF THIN CASTLE NUT 1/2" TO 1 1/2" DIAM.-FINISHED	3/4	13/16	7/8	15/16	1	1 1/16	1 1/8	1 3/16	1 1/4	—	—	—	—	—	—	—	—	—	—
$H=\frac{D}{2}+\frac{7}{8}$	THICKNESS OF THIN CASTLE NUT 1 1/2" TO 3 1/2" DIAM. FINISHED	—	—	—	—	—	—	—	—	1 1/4	1 9/32	1 5/16	1 11/32	1 3/8	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4
$W1=\frac{D}{8}+\frac{3}{16}$	WIDTH OF SLOT IN CASTLE	1/4	17/64	9/32	19/64	5/16	21/64	11/32	23/64	3/8	25/64	13/32	27/64	7/16	15/32	1/2	17/32	9/16	19/32	5/8
$H2=\frac{D}{8}+\frac{5}{16}$	DEPTH OF SLOT IN CASTLE	3/8	25/64	13/32	27/64	7/16	29/64	15/32	31/64	1/2	33/64	17/32	35/64	9/16	19/32	5/8	21/32	11/16	23/32	3/4
$C=\frac{D}{8}+\frac{1}{8}$	DIAMETER OF COTTER PIN AND DIAM. OF HOLE IN BOLT	3/16	13/64	7/32	15/64	1/4	17/64	9/32	19/64	5/16	21/64	11/32	23/64	3/8	13/32	7/16	15/32	1/2	17/32	9/16
$L=\frac{18D}{16}+\frac{1}{4}$	LENGTH OF PLAYER COTTER PIN	27/32	1	1 9/64	1 13/64	1 7/16	1 37/64	1 47/64	1 7/8	2 1/32	2 3/16	2 21/64	2 15/32	2 5/8	2 59/64	3 7/32	3 33/64	3 13/16	4 7/64	4 13/32
$L1=\frac{3D}{2}+\frac{5}{16}$	LENGTH OF COMMON COTTER PIN	1 1/16	1 1/4	1 7/16	1 5/8	1 13/16	2	2 3/16	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8	3 5/16	3 11/16	4 1/16	4 7/16	4 13/16	5 3/16	5 9/16

Castle Nuts—Plate No. 4.

7. A series of Player cotter pins with dimensions as shown.

8. A series of taper pins with dimensions as shown.

9. Both ends projecting beyond the bolt with cotter-pin hole location as shown.

SUPERHEATING.*

In 1907 comparatively few engines were equipped with superheaters in the United States, although the Canadian Pacific continued to apply superheaters to all road engines it constructed, 173 in all, bringing the total number of superheater engines on that road to 350, of which 110 are consolidation freight, 192 ten-wheeled freight and 48 passenger engines.

The most important development in the United States has been with the "Baldwin" or "Vauclain" superheater, 52 engines having been constructed during the year 1907 equipped with this device. With this exception the only other engines constructed during the year with superheaters were two on the Union Pacific, one of which was equipped with the Vaughan-Horsey smoke-tube superheater, the other with the Union Pacific smokebox type.

A statement of the engines equipped during the year so far as ascertained is as follows:

Road	Type of Superheater.	No. of Engines.
C. R. I. & P.	Vauclain	1
Pittsburg Shawmut & Northern	"	1
Central Railway, Brazil	"	2
Chicago & Alton	"	1
Santa Fe	"	49
Central of Georgia	"	1
Union Pacific	Vaughan-Horsey	1
Union Pacific	Union Pacific	1
Canadian Pacific	Vaughan-Horsey	173

The Baldwin Locomotive Works furnished the committee particulars of a test on this superheater conducted on the Chicago Rock Island & Pacific Railway.

[The results of this test were published in The Railway Age of December 13, 1907, page 833—Eds.]

No comparison was attempted on these tests, but the Baldwin Locomotive Works concludes from the results obtained in a test of a balanced compound and simple engine in passenger service, and from the results of the tests at St. Louis, that a locomotive of this type equipped with a superheater will give a saving of 15 per cent in water consumption and 11 per cent in fuel consumption over a similar simple expansion engine. An interesting comparison made during the test was the increase in tonnage that could be handled by the superheater in proportion to the simple engine, and the absence of water in the cylinders, resulting in decreased trouble with the rod packing. No trouble was experienced in the lubrication of the balanced slide valves with the ordinary sight feed lubricator.

With the exception of the more extended application of the "Vauclain" superheater during the past year, evidently but little interest has been manifested in the system, and yet the replies from these roads on which superheater engines have been in service do not condemn them. The Great Northern, which has one passenger and one freight engine equipped with the "Schmidt" smoke-tube superheater, report two coal tests between the superheater engines and simple engines of practically identical construction.

In passenger service a test on the Kalispell division showed a saving of 13 per cent in water and 14½ per cent in coal per car mile, while in freight service on the Willmar division the saving was 30½ per cent in water and 28½ per cent in coal per ton mile, the coal figures being 137½ for the simple and 98 pounds for the superheaters per 1,000 ton miles, both very satisfactory figures for prairie type engines in freight service on an undulating road. The company also reports a comparison for nine months between a superheater freight engine and a similar simple engine, showing 137 pounds of coal per 1,000 ton miles for the superheater against 171 for the simple, and a cost for repairs of 4 cents per mile against 3.87 cents, a reduction in the coal consumption of 20 per cent with practically the same cost of repairs.

The Boston & Maine reports on one passenger engine equipped with the Cole superheater, that while the original arrangement gave them considerable trouble from leaking and from breakage of the superheater pipes near the header castings, when the engine was in good condition, it has given excellent service, and the company is taking steps to substitute improved details. The company favors further improvement until better results are obtained rather than the abandonment of superheating.

The Chicago & North-Western reports with reference to one passenger engine with the original Cole superheater, which originally gave trouble from header joints leaking, that by the substitution of ground header joints this trouble has been overcome, and states that the results have been very satisfactory the last twelve months.

The New York Central reports on one passenger engine equipped with the Cole superheater, a slight reduction in the coal consumption but no conclusion.

The Soo Line reports on one freight engine equipped with the original Cole superheater, that there has been no trouble except with leaks in the header connections, and while accurate figures on consumption of coal cannot be given there is evidently a saving, and the engine handles a train better than other engines.

The Lake Shore & Michigan Southern reports on two passenger engines, one equipped with the original Cole and the other with the Vaughan-Horsey superheater, that no further tests have been made. This road has experienced difficulty in operation as follows:

(1) Lubrication. This was first attempted with the forced feed lubricator, and afterward the ordinary sight-feed lubricator was found to give entire satisfaction.

(2) On the Vaughan-Horsey superheater the top header broke due to faulty design, which has been overcome by changes in the cross section from square to round.

(3) A number of the superheater tubes have cracked, but no remedy has been suggested.

The conclusion is that the superheater passenger engines have on the whole been satisfactory, and that while certain defects have developed, they are not of a nature that presents any serious difficulty. The engines have proved distinctly superior to simple engines of corresponding types both in economy in fuel and their capacity for handling their trains. The company considers superheating a very promising improvement and intend to apply it to a considerably greater extent.

Grant Hall, superintendent of motive power of the Canadian Pacific lines west of Ft. William has furnished a report from the master mechanics of the three divisions under his charge, having a total of 103 superheater engines at the commencement and 143 at the end of the year. As these statements cover a fairly extended experience with the original Cole, Schmidt and Vaughan-Horsey superheaters, extracts from them are quoted as follows:

"We experience trouble in keeping large superheater tubes free and clear from cinders, which, if not done, the benefit of the superheater is lost. I find that the large tube fills up and becomes choked, starting from firebox end extending about two feet in if not kept after and cleaned out regularly; to do this we use a rod, pulling back deposit with a rod with a bent end and then finish up by blowing them through with air. We also find that the small steam pipes get coated with soot, which also prevents us getting full benefit of the heat passing through the tube, which is only partly overcome by repeated blowing out with air.

"The Schmidt type is giving us very little trouble on this division, perhaps not so noticeable on account of only having one engine of this type. The main top header on this engine, however, has failed twice by cracking around the neck between the header and the flange which bolts to tube sheet.

"The jointing arrangement small superheater pipes has not given us any trouble whatever from leaking or slackening back, which is frequent with other types.

"The Cole type is a constant trouble from leakage at joints where small headers bolt to main header and can not be maintained tight for any length of time. In tightening them up, which is frequently done, the studs, which were enlarged from ¾ to ⅞ inch, are strained, broken and pulled out from main header. When leaking, the flat face on main header as well as the grooved bed in the small headers are cut by steam leaks, necessitating plugging, etc., making it very costly to maintain, not saying anything about holding engine out of service or extra fuel consumption.

"The Vaughan-Horsey type causes trouble by the union joints leaking, caused by nuts slackening off them where jointed to main header, and have to be opened up as often as business will permit and gone over to avoid failures; this being the only trouble we have with this type outside of the returns burning out occasionally, which is equal on all types."

"I am in favor of superheated steam in both passenger and freight service, and consider that we get good results when the arrangement is working satisfactorily and free from leaks. The system should be improved on to lessen

*Abstract of report presented at the annual convention of the American Railway Master Mechanics' Association at Atlantic City, N. J., June, 1908, by a committee consisting of H. H. Vaughan, Le Grand Parish and R. D. Hawkins.

the maintenance work, and the question of lubrication most thoroughly gone into with a view of reducing the number of piston and valve rings that are being used.

"With the quality of the oil we are using we find it necessary to renew piston rings every four or five weeks and the valve rings every two months. When piston rings are removed, if not broken, they are worn down to about ⅜ inch thick.

"Have had very little difficulty with respect to superheater tubes stopping up, but it is absolutely necessary that the damper in smokebox be kept in working order.

"With the Schmidt superheater we experience considerable difficulty in keeping flange joints tight where bolted on header. Have had one header broken off close outside of flange where bolted on to round head. With the Vaughan-Horsey type we have quite a lot of trouble with the brass ring nut at connections, but using the mild steel nut, I think, will overcome this to a great extent.

"My experience with superheated steam in freight service is satisfactory; have no engines in passenger service equipped with superheated steam.

"In regard to the superheater tubes blocking up in the smoke tube class. We have had some difficulty in keeping the smoke tube clean, and the only way to get good results is to blow them out each trip with air; doing so we have been able to keep them in good condition.

"We have had considerable trouble with the piston and valve rings of the superheater type. This trouble has been eliminated to a large extent by making a more rigid examination of rings and feed attachments to valves and cylinders, also by making a perfect fit of new rings when applied to piston. Another important feature toward the maintenance is the superheater dampers and their attachments. To keep these in working condition it is necessary to inspect them thoroughly every week, which will prevent any trouble from defective dampers, pistons or brackets. The worst feature is the possibility of engine failures on account of superheater pipes bursting and leaking; they give no warning and it is impossible to detect them before giving out.

"In connection with superheaters in freight service, the only difficulty was in the large tubes leaking badly, making it necessary to expand them every round trip. In passenger service I consider them very satisfactory, both in efficiency for this class of work and for the light maintenance of same."

Mr. Hall has also written a general statement of his experience from which the following are extracts:

"We find that the superheater tubes plug up to a certain extent, but we overcome this by blowing out with air. The Cole type only has given us trouble maintaining header joints. In passing I might say, for your information, that the Cole superheater has given us so much trouble in this respect that I would not recommend its use. We have had very little trouble with the Schmidt type, the principal trouble being one that can be overcome, namely, the cracking of the superheater header through the neck. The only difficulty that has been experienced with the Vaughan-Horsey has been the slackening off of the nuts coupling up the superheater pipe to the header; this type of superheater is an easy proposition to maintain.

"In regard to lubrication: We have had nothing in the shape of forced feed that gave satisfaction, and have none now in service, being replaced entirely by sight-feed lubrication. It is not necessary that we have separate cylinder connections, but I do consider it necessary to have connection to each end of the valve bushing when using superheated steam. My experience with superheated steam in both passenger and freight service is satisfactory."

On the lines east of the Canadian Pacific for which the chairman of the committee is reporting, practically the only superheater in use is the Vaughan-Horsey, as those with the Schmidt are on lines west and most of the original Cole have been converted.

The important question during the past year has not been one of economy but of maintenance, not with respect to cost, for in that respect the addition of a superheater is not noticeable, but with respect to reliability. Engine failures are annoying and expensive, and no device can be a permanent success which introduces them to any extent. The important troubles that have developed during the last year have been three in number:

1. Leakage at the union connections between the superheater pipes and the header due to nuts slackening off.
2. Bursting and splitting of superheater pipes.
3. Breakage of superheater header.

Leakage at the union connections was at first caused by brass nuts having been used, and with the change to steel nuts it appeared to have ceased. Considerable trouble has, however, been experienced with the steel nuts, although not universally, as on some divisions it is practically nil, but in many cases the nut has slacked off entirely, causing a complete and annoying failure. The reasons appear to be poor workmanship and insufficient strength of the nuts. With stronger nuts and proper workmanship, both of which can be arranged for, this trouble should be overcome, but it has been decided to apply lock nuts of which several designs are now on trial, which will without a doubt overcome the difficulty; and while a monthly inspection is required, failures from this cause will be avoided.

Bursting and splitting of superheater pipes, while not frequent, can be avoided only by proper maintenance of the dampers. This defect does not occur frequently, and is no doubt partly due to insufficient care having been taken in putting up the pipes to the correct lengths.

Breaking of superheater headers, while not frequent, has occurred several times, but can be stated definitely to be a defect in design.

Only top headers have broken and these all in practically the same place, at the junction of the steam-pipe flange with the header. By changing the form and insuring a stronger metal, there is little doubt of this trouble being overcome.

The number of failures from these causes have not on the whole been excessive. From April 1, 1907, to January 31, 1908, 39 superheater engines in passenger service made a total of 1,382,820 miles with a total of 15 failures. Of these nine were due to joints leaking, four to pipe bursting and two to headers breaking. The number of miles per engine failure was therefore 92,188, and as 11 of these failures are from causes that can be overcome it is evident that when this is done the unavoidable failures are not a serious drawback.

Figures are not available giving the failures in freight service with any degree of accuracy.

So far as the cost of repairs is concerned the addition of a superheater does not appear to be noticeable.

While discussing the difficulties introduced by the application of superheaters there are certain advantages which to a large extent offset them. Where simple engines have been converted, they have shown an increase in capacity that may be roughly estimated at about 10 per cent. They run more freely and are decidedly easier on their fire, allowing an inferior grade of coal to be burned with less difficulty; to an extent which caused a superheater passenger engine to handle trains without loss of time when similar simple engine failed to do so. There is also a notable absence in superheaters of the trouble caused by water, and on the whole, providing the difficulties mentioned are overcome, it is a close question whether superheater engines will not average less failures than a corresponding number of simple engines, and they will certainly handle heavier trains and make time. Where coal is expensive and the question is one of the adoption of a compound or a superheater, there is no doubt that the latter will give greater economy, with a smaller cost for repairs and less trouble.

The results in fuel consumption appear to confirm the statements made in the last report, namely, 10 to 15 per cent in freight service and 15 to 25 per cent in passenger service. It does not appear necessary to present these figures in detail, as this has been done in previous years, but the results for July to December, inclusive, have been gone over by sections and months, those cases being selected in which sufficient work was performed by the two classes of engines being compared to render the results reasonably reliable.

The equivalent coal is the coal which the class of engine shown would have burned had its consumption per ton mile been equal to that of the class taken as the basis of comparison, while its relative consumption is the proportion of the actual to the equivalent coal. As these quantities are calculated month by month and the traffic and weather conditions thus equalized, this method is comparatively accurate.

The comparison of simple consolidation engines class M-4b with similar Vaughan-Horsey superheaters shows the average consumption of the simple engines at 113½ per cent of that of the superheaters.

In comparing compound 10-wheel freight engines D-9 and Cole superheaters and D-10c with Vaughan-Horsey superheaters, the average consumption of the compound engines is 100 per cent and that of the Cole superheater at 107 per cent of that of the Vaughan-Horsey superheater.

A comparison of Pacific type superheater engines, Class G-2, and of 10-wheel superheater, E-5g with 10-wheel simple engines, Class E-5 (the 10-wheel superheaters are engines converted from simples and are otherwise similar) shows the saving in fuel on the converted engine works as 21 per cent and that of the Pacific type at 22½ per cent on Lines East, but this figure is subject to the larger engine doing more work for the same weight of train or handling heavier trains, although only certain sections have been included

where this variation is a minimum. The results on the Brandon & Swift Current sections are remarkable in view of the large amount of coal burned, and show, with a total of 5,250 tons, a saving of about 35 per cent.

The replies show that the question of lubrication appears to have been settled by all roads resorting to the sight-feed lubricator.

Two roads report satisfactory results with a single central connection to the valve chest as on ordinary simple engines, but the majority are using the separate cylinder connection with either one central or two separate connections to the valve chest.

On the Canadian Pacific some engines are running with one central connection to the valve chest and no cylinder connection, but the preferred arrangement is the separate connection to the cylinders with one feed to the valve chest split to feed to both ends. The cylinder connection feed is generally cut down to a very small amount when running and most of the oil fed through the valves, but the majority of the men prefer to have it in case it is required.

RESULT OF TESTS WITH BRIQUETTED COAL MADE ON THE LOCOMOTIVE TESTING PLANT OF THE PENNSYLVANIA RAILROAD AT ALTOONA, PA.*

BY A. W. GIBBS, GENERAL SUPERINTENDENT OF MOTIVE POWER, PENNSYLVANIA RAILROAD.

These tests were carried out under the direction of Dr. J. A. Holmes, expert in charge, technologic branch, United States geological survey.

It was intended to ascertain if low volatile coals of a semi-smokeless nature but friable and, therefore, not fairly satisfactory in locomotive use, could, when briquetted, be used to reduce the amount of smoke and prevent the loss sustained from the discharge of cinders, which is large in coals of this character. The coal selected had the following proximate analysis in percentages: Fixed carbon, 73.21; volatile combustible, 17.75; moisture, 2.43; ash, 6.61; total, 100. It contained 1.34 per cent. of sulphur and had a calorific value of 14918 British thermal units per pound.

A series of tests was run with the raw coal and another series with the same coal briquetted in two forms, square and round, and experiments were made with the percentage of binder from 5 per cent. to 8 per cent.

All tests were run on the locomotive testing plant, a simple cylinder Atlantic type locomotive being used, having a total heating surface including fire side of tubes of 2,320 square feet and a grate area of 55.5 square feet. The results give the full performance of the boiler, together with the draw-bar pull.

The series with the raw coal were run in such a way as to show the full performance of the boiler from low rates of evaporation to the highest possible rate of evaporation. The lowest rate of evaporation was about 18,000 pounds of water per hour, equal to eight pounds per square foot of heating surface; this being increased throughout the test until, with the briquetted fuel, an evaporation of 44,500 pounds of water from and at 212 degrees F. was obtained. This is equivalent to 19 pounds of water per hour per square foot of heating surface.

The briquets were fired with ordinary shovel and handled in the manner usually employed for coal, no necessity being found for breaking the briquets.

The following table taken from a plot of actual results shows comparatively the evaporation of the natural and briquetted coal.

Evaporation per square foot of heating surface, pounds.	Equivalent evaporation per pound of fuel Natural Lloydell coal, pounds.	Briquetted coal, pounds.
8	9.5	10.7
10	8.8	10.2
12	8.0	9.7
14	7.3	9.2
16	6.6	8.7

The quantity of cinders collected in the smokebox showed no material difference as between the raw coal and the briquetted coal. The quantity collected per hour when burning 100 pounds of fuel per square foot of grate was about 400 pounds, reaching a maximum of about 750 pounds per hour with the coal being burned at the rate of 120 pounds per square foot of grate.

Firebox and smokebox temperatures were practically the same at the same rates of evaporation, whether the coal was used in its raw state or briquetted.

The apparent reason for the increased evaporation per pound of fuel with the briquetted coal is that, although, as already stated, the loss due to cinders in the smokebox is not different as judged by the quantity collected, the calorific value of the cinders from the briquetted coal was lower than with raw coal, and, further, on account of the uniform size of the briquetted fuel the distribution of air through the fire permitted more complete combustion and liberation of heat than with the raw coal.

The fuel consumed per draw-bar horsepower with the locomotive running at a speed of 37.78 miles per hour and a cut-off of 25 per cent. was 4.48 pounds using raw coal and 3.65 pounds using round briquets.

This is equivalent to stating that the amount of briquetted coal was 81 per cent. of the amount of raw coal required per draw-bar horsepower at this speed and cut-off.

Smoke observations were made by Ringelmann's method and by photographs. By this former method no smoke is indicated by 0 and very black smoke by 5; there being a total of six gradations from 0 to 5 inclusive.

The following table indicates for a portion of the speeds and cut-offs the comparative smoke readings, these being an average of a large number of observations made at regular intervals.

Speed miles per hour.	Cut-off, Per cent.	Average smoke.	Kind of fuel.
28.34	20	1.2	Raw coal.
28.34	20	0.8	Round briquets.
37.78	25	1.8	Raw coal.
37.78	25	0.7	Round briquets.
37.78	30	2.1	Raw coal.
37.78	30	1.8	Round briquets.

It is evident from this that the briquetting of this coal materially reduced the amount of smoke, but it could not be determined whether difference in percentage of binder used made any difference in the smoke produced.

At the end of one test at about 37 miles per hour and a cut-off of 32 per cent., the locomotive was shut off and the blower put on and at the end of two minutes the smoke had entirely cleared from the stack.

Various supplemental tests indicated that with care the locomotive could be brought into a terminal where smoke was objectionable by the proper use of blower and judgment on the part of the engineman in regard to the amount of fuel in the shape of briquets fed to the fire.

There was no difficulty in starting the fire with briquets the same method being used as with the raw coal.

To determine the effect of weathering, a number of round and square briquets were placed on the roof in January and February and examined in May or about four months after and these showed no signs of change whatever in their condition.

For these tests, the briquets which had been made at the station of the geological survey were shipped to Altoona carefully stacked in open gondola cars and were carefully unloaded and restacked. Very few were broken and the amount of fine coal abraded from the surface was practically negligible.

This method of handling was all carefully done, but if the briquettes had been shipped for regular locomotive service it is not thought that the breaking and abrasion of handling briquettes would be a serious matter for regular service.

*A paper presented at the annual convention of the American Railway Master Mechanics' Association at Atlantic City, N. J., June, 1908.

Early Locomotive Requirements.

In the year 1828 the directors of the Liverpool & Manchester Railway, in order to secure a better motive power than that of horses, offered a premium of £500 for the most approved locomotive engine. Among the stipulations made were the following: (1) The engine must effectually consume its own smoke. (2) The engine, if it weighs six tons, must be capable of drawing after it, day by day, on a well-constructed railway on a level plane, a train of carriages of a gross weight of 20 tons, including the tender and water tank, at the rate of 10 miles per hour, with a pressure of steam on the boiler of 50 pounds to the square inch. (3) The price of the engine that is to be accepted is not to exceed £550, delivered on the railway, and any engine not approved is to be taken back by the owner. The prize was easily won by the "Rocket," built by George and Robert Stephenson. The type of locomotive established by the success of the "Rocket" became the then standard of England, and the directors of the London & Manchester Railway lost no time in stocking their railway with engines designed after this model.

MALLET ARTICULATED COMPOUND STEAM LOCOMOTIVES.*

The following conclusions are based on a comparison of the Mallet articulated compound types of steam locomotives now operating on American railways in road and helper freight service with other designs of steam and electric locomotives performing similar work under similar fuel, water and climatic conditions.

From a mechanical standpoint:

(1) That for the greatest permissible tonnage and speed per train, on lines of considerable gradient and curvature, the Mallet articulated compound types of steam locomotives, either with or without leading and trailing trucks, and ranging in tractive power of from 55,000 to 125,000 pounds, are relatively lower in first cost and from their performance to date more efficient and economical in operation and maintenance per unit of tractive power developed.

(2) That the Mallet articulated compound types of steam locomotives enable a practical improvement in the boiler efficiency by means of greater boiler capacity, increased reserve steam and water storage, larger grate area and firebox and tube heating surface, prolonged passage of the products of combustion through the boiler, quickened circulation of the water in the boiler, heated feed water and reduced rate of draft and combustion.

(3) That the Mallet articulated compound types of steam locomotives give the practical opportunity to improve the engine efficiency by means of relatively greater tractive effort per pound of adhesive weight and from superheated higher initial, reheated receiver and lower terminal working steam pressure due to the greater ratio of expansion that can be obtained in the cylinders as well as through the use of a large intermediate receiver capacity, which is made possible by the four independent cylinders and their supply steam connections.

That the Mallet articulated compound types of steam locomotives should have less depreciation, wear and failure of boiler and machinery because of increased reserve capacity, reduced pressure of exhaust steam, more flexible wheel base, subdivision of power and stresses over a greater number of frames, cylinders, pistons, axles, crank pins, rods and auxiliary parts; better balancing of the reciprocating and revolving mechanism, more uniform turning moment and less slipping of driving wheels.

From a maintenance of way standpoint:

(5) That the Mallet articulated types of steam locomotives having relatively less nonadhesive weight per driving wheel and a more uniform turning moment with a reduction in unbalanced pressure at the driving wheel and rail contacts, resulting in maximum adhesion, minimum slipping and a distribution of weight over a short rigid combined with a long flexible wheel base, will materially reduce the bridge, tie and rail stress and the tie and rail wear per unit of tractive power developed.

From a transportation standpoint:

(6) That the Mallet articulated types of steam locomotives either for road or helper freight service can materially increase the capacity of a given piece of track by fewer train movements and less congestion at terminals without increasing the acceleration or running speed above that which is permissible for efficient and economical heavy tonnage train movement, proper working superelevation of curves, minimum rail wear and the least liability for derailment or accident.

(7) That the Mallet articulated compound types of steam locomotives will particularly place the movement of the traffic under the control of fewer persons; lessen the liability for complete disablement and reduce the cost for engine and train crew hire, fuel, water, lubricants, stores, wiping, hostlering and dispatching.

(8) That the nonpaying weight in motive power and supplies and the retarded movement and stalling of heavy tonnage trains will be minimized by the Mallet articulated types of steam locomotives, especially through exceptionally long tunnels where the permissible reversing of this type of locomotive will not subject the crew to the gases, smoke and heat from the exhaust.

From an engineering standpoint:

(9) That the use of the Mallet articulated compound types of steam locomotives may permit of maintaining or progressively increasing the average gross tonnage per successive train movement between terminal yards to that which consistent with the balancing of the motive power, distribution of cars and the accumulation of the traffic on the divisions, might give the desired capacity as well as efficiency and economy in the operation of a single piece of trunk-line track and its terminals without making an expenditure on roadway to increase the weight limit or for a reduction of grade, curvature or distance that would otherwise be necessary to accomplish the same result.

From a general standpoint:

(10) That for service where it is essential to increase the tons moved per mile per hour per unit of cost by developing greater tractive power in one locomotive than what can be efficiently and economically produced by a consolidation or similar type and where the use of self-contained motive power, proportion of adhesive to total weight, center of gravity, distribution of weight over driving wheels, driving wheel load, flexibility of driving wheel base, and particularly the first cost, fixed charge, operating expense and reliability of service are elements of importance, the use of the Mallet articulated compound types of steam locomotives should receive careful consideration.

In arriving at the foregoing conclusions the committee has kept in mind the importance of the steam railroad mechanical engineer to the past and for the future commercial development of the transportation facilities of the country and in the conservation of the natural resources of timber, coal, lignite, oil, natural gas and other fuels which are being rapidly depleted.

Where suitable fuel is lacking or high in cost and waterpower is in abundance it is proper and may be economical to utilize that energy which only the climatic conditions of the country will change and conserve the other. Even where inferior grades of fuel are in abundance and can be obtained at reasonable cost it is most undesirable that the past and present wasteful and inefficient uses should be continued and much can be accomplished in this direction by the use of the type of steam locomotive under discussion which can produce relatively more work per unit of fuel consumed.

For general heavy freight service the movement of a given gross tonnage in fewer trains at different speeds of lower resistance is preferable to a greater number of trains at a uniform higher speed of increased resistance. Steam locomotives provide for this in a reliable and flexible combination of power and speed that will meet the varying conditions of weight, class and stops of trains as is necessary for the most efficient utilization of the track and terminal facilities. Although electric locomotive service may be capable of producing comparative hauling capacity in the handling of light and heavy tonnage on a single track by means of its essential and inherent elements of fixed high acceleration and speed, as well as earning power through the medium of the surplus current and certain auxiliary city, terminal and tunnel advantages, still the limitations with respect to the combinations of tractive effort and speed and the large number of systems in an experimental stage from which to arrive at a choice, makes the advisability of such an installation problematical when it is known that steam locomotives under similar conditions can enhance their characteristic self-contained and independent earning power by means of heavy, continuous tractive effort that can be developed for long periods at variable or constant speeds and thereby promote the quickest movement of trains of different classification and tonnage consistent with dispatching and resistance due to speeds that will come well within the established limits of reliable, efficient and economical transportation, motive power and maintenance of way performance, and allow of the minimum first cost, interest, depreciation, taxes and insurance for roadway and equipment.

Therefore, before deciding that electric locomotive performance will justify the high cost for the installation of a rapid, uniform, continuous speed system for the handling of light and heavy tonnage over one track, care should be exercised that comparison is made with the best steam locomotive practice obtainable, as otherwise the determinations may be misleading and result in costly experiences, particularly through the load factor.

These locomotives were used in the mountainous districts of Europe for a number of years before 1904, at which time the design was modified to suit the American requirements. They are adapted for general road as well as helper freight service and the same ratio of efficiency will obtain for the lighter as with the heavier designs.

The particular features are—the greater proportion of the total weight that is distributed over a shorter rigid and a longer flexible driver-wheel base; the comparatively low driver-wheel loads; the relatively higher tractive power per unit of weight per wheel; the automatic regulation of the tractive effort between the two sets of engines; the distribution of the tractive power between two groups of driver-wheel bases, running gear, frames and cylinders; the introduction of the compound principle with independent cylinders and large intermediate receiver capacity; the greater reserve capacity in the boiler and through the use of direct pressure steam in the low pressure cylinders; the combination of extreme power

*Abstract of a report presented at the annual convention of the American Railway Master Mechanics' Association at Atlantic City, N. J., June, 1908, by a committee consisting of J. E. Muhlfeld, F. H. Clark, T. Rumney, G. H. Emerson and C. J. Mellen.

in two sets of engines with one boiler and tender under the control of one engineer and fireman; a greater percentage of paying tonnage to be hauled per total weight of locomotive and train and less liability for complete disablement.

Baltimore & Ohio Railroad Performance.

The first locomotive put into operation in this country was for the Baltimore & Ohio Railroad, its object being to determine upon the practicability of such a class of motive power to efficiently and economically increase the capacity of a busy, mountainous line in event that might become necessary. The design of the experimental locomotive decided upon was of the Mallet articulated duplex compound steam type, and the construction was completed in April, 1904, after which the locomotive was exhibited at the Louisiana Purchase Exposition, and later put into regular helper freight service on the Connellsville division on January 6, 1905.

The following data are self-explanatory and shows the actual results from the performance of this locomotive for the 3⅛-year period ending May 5, 1908:

	Freight Service.		
	Road.	Helper.	Total.
Engine crew or constructive mileage (on basis of six miles per hour)	1,798	139,104	140,902
Locomotive or actual mileage	1,798	76,601	78,399
Time unavailable for transportation department use	1,027 days or 84.5%		
Time available for transportation department use	189 days or 15.5%		
Water used per pound of coal consumed	6.23-lb.		

COST IN CENTS PER MILE RUN.

For:	On basis of Constructive Mileage.	Actual Mileage.
Engine crew hire	10.16	18.27
Fuel	9.30	16.71
Repairs	4.96	8.92
Wiping, hostlering and dispatching	.89	1.60
Lubricating oil, grease and waste	.51	.91
Water	.45	.82
Sand, illuminating oils and other supplies	.29	.51
Total cost	26.56	47.74

The actual mileage includes only the road miles made by the locomotive and does not provide for the time that it had a crew and was waiting for trains, working around terminals and switching, a considerable proportion of which occurs in helper freight service and for which an allowance is made in the constructive mileage.

The following essential features, which were somewhat radical as compared with the ordinary American railroad practice at the time this locomotive was designed, have given entirely satisfactory results: Articulated frame; elimination of truck wheels; Mellin system of duplex compounding; flexible joints to the receiver and exhaust pipes; Walschaerts motion gear; combination hand and power reversing gear; high pressure piston and low pressure double-ported slide valves; high and low pressure steam balanced piston packing rings; method of securing high pressure cylinders to boiler; single disc balanced main throttle valve, and 235 pounds working steam pressure.

No difficulty has been experienced with the tracking and riding qualities going forward or backward, around maximum curvature or on straight track, either when pushing, pulling or braking trains or running light. The performance has demonstrated that neither leading nor trailing truck wheels are necessary, which overcomes the objection to the added dead weight, increased number of revolving, swiveling and other parts and greater number of wheels and bearings for wear and lubrication. There is also the objection to truck wheels due to the increased resistance levers and friction when entering and leaving curves as produced through the supporting centers having to be carried farther forward from the swiveling point than would be necessary where truck wheels are not used and which latter arrangement provides a more flexible balancing and curving locomotive. The driver-wheel end play and flange wear has been more favorable than, and on slippery rail there is not the same relative loss of power as with, the Consolidation type locomotives, for the reason that in the former there are two separate sets of connected driver-wheels and engines which can act automatically independent of each other in regulating the tractive effort, whereas with the latter all driver-wheels must act in unison.

With oil lubrication to the driver axle bearings, to the present date but one journal has required turning because of heating.

The combination of surge plates in the boiler with the use of the single disc main throttle valve has eliminated priming and provided dry steam at the high-pressure steam chests, and no trouble has been experienced with condensation in the low-pressure cylinders.

There has been no trouble due to trains parting either when pulling or pushing and the following table shows the weights on driver-wheels and the tractive and horsepowers as compared with other steam and electric locomotives performing similar service, at running speeds of 10 miles per hour:

Kind of locomotive.	Weight on driver wheels, Pounds.	Tractive power, Pounds.	Horsepower.
Mallet articulated, steam,			
In simple gear	334,500	91,300	2,434
In compound gear	334,500	71,500	1,906
Two sections, electric	320,000	70,000	1,866
One section, electric	160,000	35,000	933
Consolidation, steam	173,000	42,168	965

The Mallet locomotive has been operated by regular and pooled crews consisting of one engineer and one fireman and the latter have not been taxed to their physical capacity.

Injectors of 4,500 and 5,000 gallons per hour capacity are used on the left and right sides of the locomotive, respectively, either of which will supply the boiler when developing the maximum horsepower.

No defects have developed in the boiler sheets or in the method of attaching the high-pressure cylinders to them. The firebox is in excellent condition and with the exception of a few fire cracks extending from some of the rivet holes at the seams and at the furnace-door holes, but which have given no indication of leakage, is as good as when applied. The number of solid staybolts removed for partial and entire fractures and all other causes is 158, and the 2¼-inch diameter 21-foot length flues have been reset but twice, not including the third resetting, which will be made this month.

The firebox, staybolt and flue performance of this locomotive operating with 235 pounds gage steam pressure has been more favorable than for Consolidation simple type locomotives working under the same fuel, water and service conditions with 205 pounds indicated steam pressure.

The flexible joints at each end of the receiver pipe which conveys the high-pressure cylinders exhaust steam to the low-pressure cylinder valve chambers have received no attention with respect to either renewals, repairs or adjustment and there has been no leakage, probably because of the fact that the long lever arm results in but slight movement of the joints.

The Walschaerts valve gear, which is the oldest now in use on any locomotive in this country, has more than demonstrated its superiority in every respect over the Stephenson and similar forms of motion gear for modern locomotive construction.

Taken as a whole, the design of the locomotive can be considered as satisfactory, and the only changes found necessary or made in the original construction have been to strengthen a weak cross equalizer and the driver springs; to change the flexible connections between the oil delivery pipes and the low-pressure cylinder steam chests and to rearrange the rocking and drop grates and operating gear.

While the locomotive receives fire cleaning, fuel, sand, water, washing out and minor running repairs at Rockwood, Pa., from which point it is dispatched for helper freight service, the heavier running and the classified repair work must be done at the divisional enginehouse at Connellsville, Pa., to which station it is diverted at periodic intervals.

As compared with Consolidation simple type locomotives the fuel consumption per ton mile is considerably less on the level, somewhat less on the combined level and mountainous and slightly less on the mountainous lines.

This locomotive is doing the work of two standard Consolidation simple locomotives and the results from its service has more than met the expectation of the builders and owner and has established the practicability and the advisability for the use of this class of power for the purpose as intended.

Erie Railroad Performance.

The Erie Railroad put into service in September, 1907, three Mallet articulated duplex compound steam types of helper freight locomotives, the high and low pressure sets of engines each consisting of four pairs of connected driver-wheels.

These three locomotives retired nine heavy Decapod and

Consolidation locomotives with tractive powers ranging from 35,560 to 40,000 pounds. The cumulative performance of the three locomotives for the 6-month period ending March 31, 1908, is shown in the following:

Total actual locomotive mileage..... 31,763
Total tractive power mileage..... 3,011,132,400
Average cost for maintenance per locomotive mile ..... 12.86 cents.
Average cost for maintenance per 10,000 tractive power miles ..... 1.35 cents.

The service of these locomotives to the present date has been satisfactory, but inasmuch as they have not yet been in use for a sufficient length of time to require classified repairs, the ultimate cost for maintenance can only be estimated.

Road tests were recently made to determine:

(1) The coal and water consumption.
(2) The draw-bar push.
(3) The steam distribution and back pressure in the high and low pressure cylinders, dryness of steam and horsepower.

Owing to the limited capacity of dynamometer car used the locomotives could not be operated at their maximum tractive power.

There was a variation in the number of revolutions of the driver-wheels of the low pressure or forward as compared with the high pressure or rear engines which may be accounted for by the difference in the diameter of the driver-wheels, due to wear and by the independent slipping which, however, seldom exceeded one-half of a revolution. The difference in the speeds of the locomotives which were obtained by calculation from the diameter of the driver-wheels and the number of revolutions per minute as compared with that recorded by the dynamometer car which was obtained by a speed recorder, can be attributed to the same cause, which will also apply as the reason for the variation in the curves representing the indicated and the dynamometer horsepower.

Reference to the alignment of the road covering that portion of the run as included by the log will show the considerable curvature and opportunity for the driver-wheels slipping.

A feature of these tests is the quality of steam obtained, more especially in the long, exposed receiver, where over 98 per cent of dryness was maintained throughout the run, indicating that the low-pressure cylinders are furnished with practically the same quality of steam as the high-pressure cylinders, and which in all probability is due to the large volume of the intermediate chamber whereby wire-drawing and consequent reheating of the steam is obtained before it enters the low-pressure cylinder valve chambers.

The indicator diagrams show very clearly the effect of the high-pressure cylinder exhaust on the receiver and low-pressure cylinders' pressures. In this connection the following items are of interest:

(1) That the opening of the admission or the cut-off of the low-pressure cylinders has no appreciable effect upon the exhaust line of the high-pressure cylinders as is usually found in compound locomotives.

(2) That the exhaust of the high-pressure cylinders may occur at any point in the stroke of the low-pressure pistons and actually does vary continually, although the ideal condition would be where the high-pressure cylinders' exhaust comes just at the time of admission to the low-pressure cylinders, or just following the point of cut-off, where in both cases the low-pressure cylinders would receive the full benefit of the maximum pressure in the receiver at the commencement of the stroke of the pistons.

The dynamometer card records have unusual characteristics, such as a uniform draw-bar effect covering a distance of 2,000 feet traversed in three minutes. This performance is more possible with an articulated duplex compound steam locomotive than with any other type, because of the two sets of engines assuming a relation wherein the cranks are one-eighth of a revolution apart and maintaining an almost constant push or pull. The considerable variation in the draw-bar push at the end of the uniform tractive effort is undoubtedly due to one set of engines slipping slightly and getting in step with the other set.

A part of a run over very slippery rail during which the supply of sand became exhausted, but the draw-bar was but slightly decreased by that action, because only one set of engines would slip at one time and the slipping would seldom cover an entire revolution, because of the automatic regulation of the tractive effort between the two sets of engines, which immediately occurs when either set of connected driver-wheels lose their adhesion.

Some data for three runs are as follows:

Run No.	1	2	3
Time, minutes	60	63	113
Speed, miles per hour	6	6	5
Piston speed, feet per minute average	187	187	154
Boiler pressure, pounds	200	200	195
Draft, inches of water	4.7	5.0	4.5
Water evaporated, pounds	42,905	39,718	47,978
Dynamometer stress, pounds, average	64,000	66,000	64,000
Dry coal (bituminous) fired, pounds	4,910	.....	7,000
Dry coal fired per hour, pounds	4,910	.....	3,980
Dry steam per hour, pounds	42,500	37,065	25,000
Dry steam per square foot heating surface per hour, pounds	7.96	6.95	4.70
Equivalent evaporation from and at 212° F. per square foot per hour, pounds	9.85	8.62	5.92
Equivalent evaporation per pound of dry coal, pounds	10.70	.....	8.08
Boiler horsepower	1,520	1,330	900
Indicated horsepower	1,141	1,012	886
Dynamometer horsepower	1,021	889	710
Dry coal per indicated horsepower, pounds	4.42	.....	4.50
Dry Steam per indicated horsepower, pounds	37.2	36.9	29.0

Great Northern Railway Line Performance.

The Great Northern Railway now has in service 22 of the larger or helper freight type of Mallet locomotives on the mountainous grades on its Cascade division, and 45 of the smaller or road freight type on the districts where the maximum grade varies from 0.6 per cent to 1 per cent. To the present date the cost per actual road mile run for five of the helper freight locomotives, which were put into service in November, 1906, has averaged as follows:

Engine crew hire, wiping, hostlering and dispatching ..... 27.06 cents.
Fuel ..... 55.22 "
Repairs ..... 9.83 "
Lubricating oil, grease and waste..... 1.76 "
Sand, illuminating oil and other supplies. .39 "

Total ..... 94.26 cents.

The relatively high cost for fuel is because of the use of a semi-bituminous coal which will evaporate not to exceed 3½ pounds of water per pound of coal.

The cost per actual road mile run for 25 of the road freight locomotives that were put into a 201 miles continuous trip service in November, 1906, where the locomotives are pooled and crews changed midway of the district, averaged as follows to the end of the fiscal year ending June 30, 1907:

Cost of repairs per mile..... 6.72 cents.
Coal consumed per 100-ton miles excluding weight of locomotives..... 19.18 pounds.

The use of the Mallet locomotives has enabled the following increase in the through freight train gross tonnage, not including the weight of the motive power:

Cascade Mountain division: Increase from 1,050 to 1,450 tons.

Leavenworth, Wash., to Spokane, Wash.: Increase from 1,100 to 1,450 tons.

Whitefish, Mont., to Havre, Mont.: Increase from 1,300 to 1,700 tons.

Williston, N. D., to Minot, N. D.: Increase from 1,600 to 2,200 tons.

This represents an increase of approximately 35 per cent in the freight train gross tonnage and has eliminated congestion in yards which was previously occasioned by the use of Consolidation locomotives.

With the present arrangement there is but one place on the entire system between Seattle, Wash., and St. Paul, Minn., where it is necessary to reduce through freight train tonnage—that is, a train leaving Seattle, Wash., with 1,450 tons arrives at Williston, N. D., a distance of 1,180 miles, with 2,500 tons and is then reduced to 2,200 tons, which the smaller Mallet road locomotives handle successfully without helper on a 0.72 per cent grade.

From tests recently made on the district between Havre, Mont., and Cut Bank, Mont., it was found that the coal consumption averaged 14.3 pounds per 100 ton-miles as compared with 28 pounds as consumed by the Consolidation type locomotives, or a saving representing approximately 49 per cent. On the district between Minot, N. D., and Williston, N. D., the result of a 60-trip test shows 11.04 pounds of coal consumed per 100 ton-miles west-bound, and 9.27 pounds of coal consumed per 100 ton-miles east-bound. The performance of the Consolidated locomotives over the same district for the fiscal year ending June 30, 1907, averaged 19.25 pounds of coal per 100 ton-miles, showing a saving of approximately 47 per cent in fuel consumption.

On the district between Clancy, Mont., and Moodville, Mont., the annual performance of Consolidation locomotives averaged 33.1 pounds of coal per 100 ton-miles. From a series of tests made with the Mallet locomotives during

March of this year, with an increase of one-third in the train tonnage, the coal consumption was somewhat less than 25 pounds per 100 ton-miles.

The conclusions with respect to the operation and maintenance of the Mallet road and helper freight locomotives as put into service on the Great Northern Railway Lines is as follows:

Operation.—Very little trouble has been experienced in the handling of the heavier trains on the mountainous districts and less difficulty has been experienced on account of break-in-two's as compared with the simple Consolidated type locomotives, which is accounted for by the automatic independent action of the two sets of connected driver-wheels and engines. It has also been demonstrated that the firing of these locomotives with the quality of fuel available is within the capacity of one fireman, although the use of some type of locomotive stoker is being considered on account of the heat from the furnace door opening.

From the performance to the present date it is thought that a considerably lower ratio of adhesion is permissible with the Mallet type locomotives as compared with other classes.

Design.—The question of flange wear was carefully considered due to the fact that the locomotives would be required to operate in both directions without turning. It was decided to provide leading and trailing wheels in combination with radial trucks and the results have been very satisfactory.

Maintenance.—The cost for repairs per mile run will necessarily average higher than for the simple Consolidation locomotives, but on the basis of 100 ton-miles it is materially reduced. While no trouble has been experienced in keeping the flexible low pressure steam and exhaust pipe joints tight they have required considerable attention and consideration is now being given to the use of a metallic packing. On the first locomotives built the high-pressure cylinder saddles were secured to the boiler shell by means of studs, which caused considerable trouble due to their working loose and leaking. This difficulty has been overcome by the use of cast-steel cylinder saddles, which are riveted to the boiler shell. During the winter months some trouble was experienced through having to keep the cylinder cocks open to relieve the condensation due to the low pressure steam coming in contact with the low pressure cylinder large wall area. It is the opinion that the use of some form of reheater or superheater would overcome this difficulty and bring about a considerable improvement in the efficiency. On account of the trouble experienced in supplying sand to the rail ahead of the first driver wheels to the low-pressure or articulated engine, it was found necessary to locate an independent sand-box between the cylinders of the low-pressure engine, and which has overcome the difficulty due to the original sand-box location on top of the boiler.

The foregoing information is self-explanatory as to the results that have been obtained from the use of these locomotives, and justifies the general conclusions as set forth in this report.

Northern Pacific Railway Performance.

The Northern Pacific now has in helper freight service 16 Mallet locomotives of similar type to those in use for the same class of service on the Great Northern. Two of these locomotives are now in use on the Cascade Mountain lines, and from which operation it is expected to secure some valuable comparative performance data. While some weak points have developed in the operation and maintenance, more especially in connection with the flues, the locomotives in general are rendering good service and haul an increase of about 300 tons in train up a 2.2 per cent. grade as compared with the other heaviest types of mountain-line locomotives in similar service on that railroad.

Chicago, Burlington & Quincy Railroad Performance.

The Chicago Burlington & Quincy has had one of the Great Northern helper freight Mallet locomotives in service for some time past and has recently put into use two additional locomotives of this type. To the present date your committee has been unable to secure any detailed information of the performance of these locomotives except such as pertains to the one Great Northern type.

American Railroad of Porto Rico Performance.

Three of the four Mallet locomotives in use on this railroad operate between Mayaguez and Lajas to transport the sugar-cane traffic.

Two locomotives, each in service about 16 hours, handle a total of 90 loaded cars, each of 15-tons capacity, every working day, while the third locomotive is retained in reserve.

From Mayaguez to Filial Amor the Mallet locomotives are assisted by one Consolidation type to hasten the formation of the loaded car trains and to distribute empty cars. From Filial Amor to Lajas the loaded and empty movement is handled by the Mallet locomotive.

The fourth Mallet locomotive is in service on another section.

The performance is satisfactory.

Miscellaneous Railways Performance.

With respect to the three Mallet locomotives in service on the Central Railway of Brazil, and the two on the Guayaquil & Quito Railway of Ecuador, the committee regrets that up to the present time it has been unable to secure any detailed data pertaining to their performance or maintenance. What information has been secured indicates that they are giving satisfactory results and are suitable for the purpose for which they were constructed.

The man who is interested in the new type of Seamless steel bell should go once more to the National Tube Company's exhibit at spaces 400 and 402 and listen again to the chime, and any information he may desire will be given by those in charge. The man who is interested in boiler tubes should not fail to be informed in regard to "Spellerized" boiler tubes, and at the same booths are shown all the Kewanee Specialties which are applicable to railroad work.

Among recent sales of pneumatic flue welders made by the Draper Manufacturing Company of Port Huron, Mich., were the following: Maine Central, Portland, Me.; Western Boiler Works, Los Angeles, Cal.; Manistee Iron Works, Manistee, Mich.; Minnesota Land & Construction Co., Virginia, Mich.; Baldwin Locomotive Works, Philadelphia, Pa. This flue welder is giving the best results wherever used, not only in railroad shops, but also in contract shops on all sizes of flues.

A Yale lock cylinder enlarged to several times the regular size and with the interior mechanism laid bare, is operating by a motor at space 215. The application of the paracentric key and the system of pin tumblers, which have made Yale locks famous for security, are exposed, showing just how the opening of the lock is effected, when the right key is inserted.

THOR REVERSIBLE WOOD-BORING MACHINES.

The accompanying engraving illustrates a No. 14 Thor pneumatic reversible wood-boring machine, boring holes for car floor washers 3½ inches in diameter. These machines are built in various sizes by the Independent Pneumatic Tool Company for boring holes in wood up to four inches in diameter

Thor Reversible Wood-Boring Machines.

and to any depth. They are of the piston type, have Corliss valve motion and are provided with crank chamber plates which permit of easy access to the cranks, toggles, etc. They can be reversed while running at full speed by simply turning the handle to the right or left, thus withdrawing bit instantly.

With Exhibitors and Others

The working model of a locomotive valve gear exhibited at booth 401 is not a Walschaert gear, although somewhat similar in appearance at first glance. It is the Baker-Pilliod valve motion, the puzzle in connection with it being to find the missing link. One of the great advantages claimed for this gear is that it may be applied to any existing cylinder and valve arrangement. The maintenance is also said to be very low.

* * *

In the exhibit of Jenkins Brothers, is being shown the new feature of this year in the way of a medium pressure gate valve for pressures up to 150 pounds. To these are added the full lines of extra heavy gate valves up to 250 pounds. For superheated steam, they are showing special steel valves, that is the spindles, clappers and all inside linings. As usual, they have "96" packing, pump valves and gasket tubing. The exhibit also contains their regular line of globe and angle valves, check valves, "Y" blow-off valves and radiator valves.

* * *

F. O. Ketcham, general manager of E. L. Post & Co. Inc., New York, did not bring an exhibit of "Zero" and "Motor" metals with him to this convention, as most of the visitors here are familiar with the merits of these bearings for cars and locomotives. The Motor metal is particularly successful on electric motors.

* * *

The Butler Drawbar Attachment Company, Cleveland, Ohio, in space 57, exhibits two types of piper friction draft gear. This draft rigging was developed by a practical railroad man, incorporating those important elements emphasized in railroad service tests. The Butler rigging appears to meet the requirements of the Association, as it has a capacity of 30,000 to 40,000 pounds in the first 1 to 1½ inches travel, the capacity being then increased to a maximum of about 150,000 to 200,000 pounds. Greater capacity than this is thought not advisable, since above this the transition from the preliminary spring action to the frictional operation is rough, transmitting severe shocks to the attachments and framing of the car. Another special feature of the Piper draft rigging is that when the gear closes, solid iron faces meeting protect the yielding parts of the gear. The blow is, therefore, transmitted to the car. The convention exhibit also includes some types of tandem draft gears which are said to have proved themselves among the strongest in the market.

* * *

The Greek Temple on the convention pier, the building in which the meetings of the two associations have been held, is covered with the famous Ruberoid roofing, manufactured by the Standard Paint Company, New York. The excellent water-proof qualities of this roofing are uniquely demonstrated at the company's exhibit. The aquarium tells the story.

* * *

The Buckeye Steel Castings Company, Columbus, Ohio, is exhibiting several new designs in cast steel. These include the Buckeye cast steel pivotal coupler yoke designed to obviate trouble from sheared rivets; a side operating coupler adjustable for coupling on curves; the Acme and Carmer uncoupling devices; a new side-operating coupler suitable for use in connection with passenger equipment; the Buckeye steel truck bolster, and a cast steel truck side which has two new features—separable tapered bolts for securing brake hangers, and pedestal ties cast integral with the truck side. The Major coupler operated from the bottom—a design widely used on the Chicago, Milwaukee & St. Paul—is also shown. S. P. Bush, George Groobey, J. C. Whitridge and George T. Johnson represent the company.

* * *

The Westinghouse Automatic Air & Steam Coupler Company advises us that notwithstanding what has been said in comment and discussion during the convention and despite the impression that the report of the committee on automatic connectors before the Master Car Builders' Association may have given, the company is still a firm adherent to the principle exemplified in the side port connectors designed and for a number of years manufactured by the Westinghouse interests. The company states, furthermore, that it is not at all its intention to abandon its present device, at least until the superiority of some other form of device has been sufficiently tested and proven in service. The Westinghouse side-port apparatus has been in successful operation for the past seven years on all the passenger cars and engines of the Putnam division of the New York Central railroad, and for four years on all the passenger cars and engines of the Long Island Railroad, and numerous equipments are in daily use on other roads.

* * *

The Whiting Foundry Equipment Company, Harvey, Ill., (Chicago suburb), is installing in the new plant of the Commonwealth—Edison Company, at Chicago, a 90-ton single trolley electric traveler which is one of the largest single trolley cranes ever built.

* * *

The Cleveland Car Specialty Company, Cleveland, Ohio, space 55, is showing a line of steel pressings, including side and window posts, carlines and low deck suports. The new type carline has a broad wooden nailing strip for attaching the roof.

* * *

Some nice work on cross-head pins is being done at the exhibit of the Gisholt Machine Company. A number of 5⅛-inch by 11⅝-inch pins have been made at odd times during the convention, the time for each pin averaging well under an hour. One of the pins was completed in about 35 minutes, which is considered excellent time under the existing conditions and the unsteadiness of the power.

* * *

A feature of the Gisholt boring mills shown in space 138-142 that is attracting considerable attention is the automatic feed-tripping device. At either end of the cross rail are two dials, one controlling the vertical, the other the horizontal feed. By setting the dial at the desired position the feed is automatically tripped when the cut reaches the given point on the work. In addition to this the device also trips the feed automatically when either limit of traverse is reached.

* * *

At the exhibit are also shown photographic views of the plant of the Dominion Car & Foundry Company, of Montreal, Canada, as well as pictures of various steel cars manufactured by this company, including flat cars with steel underframe, high and low side gondola cars, gondola cars with both side and center hopper dumps and other cars of steel and part steel construction.

* * *

Edwin R. Kent & Co., New York and Chicago, guarantee a service of eight to one for their Allen "Stag" manganese solid cast steel frogs and crossings, as compared with those built up of steel. Maintenance is a small item in these frogs and crossings due to the almost total absence of bolts and nuts. The crossings are made in two pieces and the only bolting necessary is at the joint and with the rails of the track. An installation of eight frogs in a large terminal, some of which have been in for 14 months, has given perfect satisfaction and shown no perceptible wear. Several two-

piece crossings in service for two years, both in the United States and Europe, at points of very heavy traffic, fail to show any bad effects therefrom. The company also manufactures Allen high speed and carbon steels; Turner iron-fibred steel for piston rods, crank pins, driving axles, wheel centers and boxes, crossheads, rocker arms and boxes, eccentric straps, engine frames, etc., being well adapted for all sorts of locomotive castings.

EXHIBIT OF AMERICAN STEEL FOUNDRIES.

The exhibit of the American Steel Foundries in spaces 169-181 is arranged with a car truck revolving on a turntable as a central feature, about which other parts of the exhibit are grouped. The truck, with the exception of a few parts, is complete with products of the company's manufacture, the latter including Davis cast steel wheels, Andrews cast steel side frames, cast steel journal boxes, Simplex springs, simplex truck bolster, cast steel body bolster, Susemihl roller side bearings and Simplex brakebeams. On a suitable rack are mounted a Simplex coupler with top operating device, an R. E. Janney pilot coupler for locomotive tender service and a Simplex coupler with a bottom opening device which is operated by means of a lever from the side of the car. The first of these couplers is arranged to couple with an R. E. Janney coupler mounted on a truck which is moved on a short section of track by means of compressed air, thus showing both the Simplex and Janney couplers in actual operation. The R. E. Janney coupler is well known and at the present time some 500,000 are in service. The Simplex coupler has but recently been placed upon the market and some of its features are a large locking surface (5½ square inches) on the knuckle, coupler wall and lock; short lift required to operate. A 2-inch lift will uncouple, 3¾-inch lift will throw the knuckle open to the extreme limit: the knuckle opens in line with the coupler ear, giving the greatest possible opening, so that it is not necessary to open the knuckles of both couplers in coupling; section of metal forward of lock hole through the face of coupler 1¼ inches thick at the throat, 1⅞ inches thick at the top; positively throws the knuckle wide open from any position; lock-set acts positively for any position in which coupler may stand; lock can also be dropped from the lock-set position to the locked position by means of uncoupling lever; anti-creeping device prevents accidental uncoupling through creeping of the lock; uncouples automatically in case draft gear pulls out; adapted to side uncoupling; applicable to passenger equipment, knuckles and locks interchangeable for freight and passenger coupler. This coupler does not require special chain or parts in attaching to uncoupling lever and it takes the standard M. C. B. link and clevis. The side operating freight coupler can by means of the uncoupling lever be centered without going between the cars. A Leeds reversible pilot coupler for locomotives is also exhibited, as well as various coupler shanks showing the resistance to drop tests.

Three racks are used in displaying Simplex solid I-section and trussed brakebeams. A specialty is being made of the new Hercules trussed beam which employs a specially rolled channel for the compression member and a rod for the tension member with malleable and cast steel fulcrums. These beams are designed to meet all classes of service from light freight to the heaviest high speed passenger. Beams for the latter service are designed with or without adjustable heads, the adjustable feature allowing the beams to be used in any position from 6 inches above the rail to the center of the wheel. In adjusting the heads it is only necessary to remove the ½-inch cotter pin, put the shoe into the position desired and replace the pin, an operation easily understood by any class of labor.

Cast steel and Simplex body and truck bolsters are shown, the cast steel truck bolsters embracing various types, I-section, T-section, box, and open end U-section for various capacity cars.

An elaborate exhibit of springs includes both coil and elliptical for all classes of cars and locomotives. Coil springs of standard M. C. B. dimensions for cars are shown further in connection with the Sloan spring control, especially applicable to passenger equipment and freight cars carrying live stock, etc., where it is essential to secure more easy riding than is obtained with the ordinary coil spring. Elliptical springs with patented clips and of various sizes and group arrangement are shown.

Susemihl roller side-bearings, of which some 200,000 are now in use, are displayed, there being at various designs to suit different arrangements of truck parts. The bearing consists of two hardened steel rollers fitted in a carriage and operating between top and bottom hardened steel plates. It is designed so that all parts remain in tact with the truck bolster in case the car becomes separated from the latter and it is impossible for any of the parts to fall out or to get out of place. There are no springs, bolts, rivets, or other small parts to become misplaced or to be lost. Bearings are further designed to allow for a travel equal to the greatest possible movement between car body and truck, even when rounding the sharpest side track curve.

The Andrews cast steel side frame, of which some 300,000 are now in service, and which is standard on a number of the largest railway systems of the United States, is shown in the assembled truck above referred to. This frame gives a side construction of one piece for the truck and replaces the arch bars, columns, column bolts, nuts, brake hanger brackets, spring seats, etc. It is easy to assemble and it is claimed that the saving in repair costs as well as that due to the shorter time the cars are out of service for repair is material and fully justifies the replacement of the old form of truck frame by that of cast steel. The construction is very strong and especially on the larger cars is in many cases replacing other forms of construction.

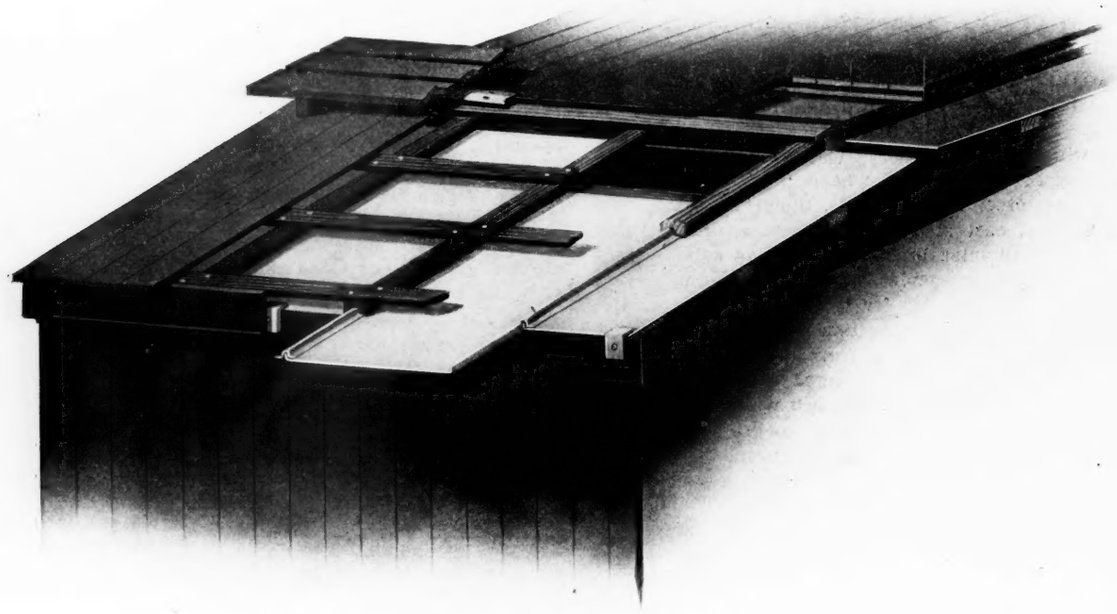
Specimens of steel of round and square sections are exhibited to show the great flexibility of the steel used in the various products of the company described. Some of these sections are bent double about the sharpest radii, and others are twisted into spirals without any tendency to break.

Miscellaneous castings in the exhibit consist of a cast steel locomotive driving wheel center, locomotive cross-heads and truck end and column castings.

Probably the feature of most interest in the exhibit is the Davis cast steel wheel. The fact that this wheel has made, in actual road service, from two to three times the mileage of cast iron wheels is sufficient to cause the merited attention which it is receiving. Although originally intended for use under 100,000-pound capacity cars, where cast iron wheels are not giving very good service, the Davis steel wheel is at present in use on over fifty roads, used for passenger, freight and tender service. The Davis wheel is cast in a revolving mold, the metal being poured at the center. When the first metal that enters the mold, powdered ferro-manganese is added, the supply of which is shut off after the rim and tread have been filled. The result of this operation is to produce a high manganese steel in the tread and flange, and a low manganese steel in the plate and hub. The wheel is then annealed, the tread and inside of the flange being further hardened with a water spray, giving a tough material to resist wear, while the metal of the hub is soft and workable to facilitate machining for the axle fit. Being too hard for machining, the periphery of the wheel is ground from the apex of the flange to the outside of the tread, insuring a perfect wearing surface. The wheel is said to be within a few thousandths of being perfectly round. For 100,000-pound capacity cars, it weighs about 600 pounds. One of the particular features of the Davis steel wheel is its great strength and safety.

ROBERTSON BOX CAR ROOF.

The Robertson box car roof, as shown by the accompanying perspective view, is the inside type. It consists of sheets of asbestos protected metal extending from within a grooved recess in the ridge pole to the outer edge of the fascia boards, having a flange on each side turned up 1 inch and butting closely together. These upturned edges or flanges fit into a grooved strip of the same material, fitting snugly over them,



Robertson Box Car Roof.

which is held in place by a grooved intermediate carline. This carline is tenoned at one end and fits into a mortised recess in the ridge pole, in such a manner as to be firm yet flexible. The outer end of this grooved carline is secured by screw or bolts to the side plate. This form of joint between the roofing sheets is said to be weather-tight and also provides for all oscillation or working of the car frame, without breaking down or deteriorating. Each sheet is further secured by a malleable iron clip. A model of this roofing is exhibited by the Asbestos Protected Metal Company, Canton, Mass., in booth 565.

THE BRILL HIGH-SPEED TRUCK IN STEAM AND ELECTRIC SERVICE.

The Brill No. 27-E truck is built for both steam and electric railway service. It was designed primarily for electric motor service on high speed lines and is employed as such by one hundred and fifty railway companies, in the United States and other countries, which operate at speeds of from 40 to 60 miles per hour. Some of the largest foreign steam railway systems have commenced using this truck because of its safe operation at high speeds, especially in negotiating curves, and because of its superior riding qualities.

At the beginning of the era of high speed electric railway development it was discovered that the trucks used were unsuited to the purpose; derailments were common and the truck frames were incapable of maintaining the axles in parallel. The derailments were due to three causes, first, the number or disposition of springs did not secure sufficient elasticity to allow the truck to accommodate itself to the severe conditions imposed by inferior tracks and roadbeds; secondly, while the trucks were furnished with swing bolsters there was no provision for cushioning the side movement at curves, therefore the change in the direction of momentum of the car body caused a violent contact of the wheel flanges with the rail heads, not infrequently resulting in the breaking of flanges and the overturning of rails if the speed was more than moderate; thirdly, the lack of stability of the truck frames allowed them to tilt when the brakes were applied—the tilting effect produced by brake action was revealed by tests to be as much as five inches; the wheels at the rear end of the truck were relieved of their share of the load for the time and were liable to derailment if the brakes were rapidly applied at curves or

Frames composed of riveted and built-up parts were generally used and were incapable of withstanding the diagonal strains brought to bear on them at curves. The axles quickly got out of parallel and produced friction and looseness in all of the bearings and parts in contact.

These and minor, but also important defects, necessitated radically different truck principles than those embodied in existing designs. The disasters which have occurred in recent years on the large steam railway systems in the various countries where fast schedules have been put in operation were due in the majority of cases to the faulty principles of the types of trucks employed. The Brill No. 27-E type proved completely successful from the first in meeting the difficult situation confronting the electric motor truck, and its remarkable performance and prominence in the electric railway field has been a revelation to operators of steam lines in all parts of the world. Strange as it may seem, its competitors, both in the steam and electric fields, all belong to the same types which proved unequal to the demands of high speed electric practice.

The Brill No. 27-E truck it is claimed is the only genuine improvement in railway trucks in thirty-five years and is absolutely unique in all of its principles and construction. It differs from all other high-speed types in that it possesses three sets of springs, a cushioned side swing, suspension of load on the side frames at wide apart points, the widest spring base and side frames composed of single solid forgings. Each of these features is essential to safe and smooth operation at all speeds.

There is no evidence that the Brill No. 27-E truck has ever been derailed except in collisions.

LIST OF EXHIBITS.

A. B. C. Bearing Corporation, Richmond, Va.—A. B. C. solid, lead-lined journal bearings reinforced with malleable iron; A. B. C. wedges. Represented by Walter D. Thomas.

Adams & Westlake Company, Chicago.—Adlake-Newbold electric car lighting system, Adlake acetylene gas car lighting system, continuous and removable bottom basket racks, Lindstrom brake handles, car trimmings, sliding door locks, signal lamps, long time burners for signal lamps, Represented by E. L. Langworthy, W. H. Baldwin, F. N. Grigg, E. H. Stearns, A. S. Anderson, C. B. Carson, R. M. Newbold and G. L. Walters.

Amberg Car Truck Company, Chicago.—Articulated side frame truck, Acme oil box and lid. Represented by W. E. Amberg.

American Balance Valve Company, Jersey Shore, Pa.—Balanced high-pressure slide valves, balanced semi-plug piston valves, balanced semi-plug valve for Baldwin compound engine, Walschearts valve gear model, model of modified Stevens with Jack Wilson's double-acting internal admission valves and other models. Represented by J. T. Wilson and Frank Trump.

American Blower Company, Detroit, Mich.—The new A B C multi-vane dynamic blower; type A vertical self-oiling engine; an A B C high-pressure blower in operation, holding in suspension a heavy ball 18 inches in diameter; the A B C steam-heating coils; the new Vento radiation; A B C moist air dry kiln; ventilating fans; exhaust fans, etc. Represented by Clayton W. Old, R. B. Bedford and H. F. Old.

American Brake Shoe & Foundry Company, Mahwah, N. J.—Steel back locomotive, coach and car brake shoes, steel back brake shoes for heavy electric railway service. Represented by W. S. McGowan, Frank L. Gordon, Charles Herron, F. W. Sargent, H. S. Bradfield, E. L. Janes, E. J. Searles, E. B. Smith, J. S. Thompson, L. R. Dewey, Otis H. Cutler, J. D. Gallagher and J. B. Terbell.

American Car & Foundry Company, St. Louis.—Pennsylvania Railroad steel passenger coach, class P-70, track exhibit. Represented by Scott H. Blewett, W. C. Dickerman, John McE. Ames, A. E. Ostrander, H. P. Field, Jr., E. H. Fisher, William F. Lowry, W. S. Johnson, G. A. Johnson and Frank Faust.

American Engineer and Railroad Journal, New York.—Copies of American Engineer and Railroad Journal. Represented by R. M. Van Arsdale, J. S. Bonsall, R. V. Wright and E. A. Averill.

American-LaFrance Fire Engine Company, Elmira, N. Y.—Two-wheel chemical fire engines, non-freezing fire extinguishers, Babcock fire extinguishers, approved and labeled fire extinguishers, automobile fire extinguishers. Represented by F. M. Watters, A. G. Morse and Hugh Logan.

American Locomotive Company, New York.—Reception booth. Represented by Leigh Best, H. F. Ball, David Van Alstyne J. D. Sawyer, G. M. Basford and A. Haller.

American Mason Safety Tread Company, Boston.—Mason safety treads, Empire safety treads, Karbolith composition floors for cars and buildings. Represented by Henry C. King, L. H. Myrick and J. W. Scott.

American Multigraph Sales Company, Cleveland, Ohio.—The Gammeter multigraph, multiple typewriter and office printing press. Represented by F. G. Harris, H. M. Horr and L. C. Clark.

American Railway Master Mechanics' Association Committee on Apprenticeship.—Models, drawings, photographs and methods of instruction. Represented by C. W. Cross and W. B. Russell.

American Steam Gauge & Valve Manufacturing Company, Boston, Mass.—Muffled and open pop safety valves, standard locomotive steam gages, Thompson improved indicator, dead weight gage tester, locomotive chime whistle, automatic hydraulic recording gage, duplex air brake gage. Represented by Ralph B. Phillips, Gardner Cornett, C. A. Allen and E. H. Smith.

American Steel Foundries and Simplex Railway Appliance Company, Chicago.—Cast steel body and truck bolsters, brake beams, Simplex body and truck bolsters, cross heads, R. E. Janney coupler, Simplex freight and passenger coupler, Andrews side frames, Davis wheels, springs, cast steel journal boxes, Susemihl side bearings, complete truck mounted on revolving turn table, aluminum model of complete truck, test bars and tested couplers. Represented by G. E. Scott, R. H. Ripley, D. W. Call, Theodore Cook, F. K. Shults, Geo. C. Murray, Andrew Crozier, J. V. Bell, T. D. Kelley, D. T. Harris, G. E. Slaughter, Jas. Maher, J. Soule Smith, H. P. Shaw, W. W. Butler and W. A. Blanchard.

American Vanadium Company, Pittsburg, Pa.—Vanadium ore, oxides and alloys; bars of all types of Vanadium steel, fine roller stock, automobile springs, railroad draft, tender and driving truck springs, crankshafts, axles, lathe tools, pneumatic hammer rivet dies, driving tire, valve arm, cast bronze and steel pulleys, ball races, transmission bars, engine frame, solid steel wheels and torpedo tube. Represented by J. M. Flannery, J. Kent Smith, W. L. Turner and T. F. V. Curran.

Anchor Packing Company, Philadelphia.—Metal and fibrous packings. Represented by L. E. Adams, W. R. Haggart, David Newhall, Geo. McCabe, B. Morrison, B. J. Miller, L. E. Goggin, L. H. Martell, Chas. Barnes.

Armstrong Brothers Tool Company, Chicago, Ill.—Tool holders for lathes, planers, shapers and slotters, ratchet drills, lathe tools, lathe dogs, planer jacks, drill press vise. Represented by John McBride.

Asbestos Protected Metal Company, Canton, Mass.—Robertson inside car roof, asbestos protected metal, flat, corrugated and beaded roofing and siding, special roof paint, roof cement, roofing nails. Represented by H. H. Robertson, J. T. Crawford and Robert J. Mollan.

Ashton Valve Company, Boston, Mass.—Samples of valves in room at Marlborough-Blenheim. Represented by F. A. Casey, J. W. Motherwell.

Babcock Box Company, New York.—Wire bound packing cases for prevention of concealed losses. Represented by L. W. Gill.

Baldwin Locomotive Works and Standard Steel Works Company, Philadelphia, Pa.—Reception booth. Represented by S. M. Vauclain, S. M. Vauclain, Jr., H. de H. Bright, G. Greenough, J. W. Converse, Charles Riddell, F. W. Weston, George F. Jones and E. B. Halsey.

Bardons & Oliver, Cleveland, Ohio.—Automatic chuck turret lathe, 4 inches x 30 inches, No. 4 Universal brass-working turret lathe. Represented by George C. Bardons, John G. Oliver and S. E. Horton.

Barnett Equipment Company, New York.—Barnett connector, coupling the signal, brake, steam heat and safety hooks; Barnett universal steam hose coupler; Schultz flexible train connection. Represented by S. D. Barnett, R. A. Wolff and L. G. Morris.

Beaudry & Co., Boston.—One No. 6, 150-pound Champion power hammer, three small nickel-plated models of hammers. Represented by Alex Beaudry and Otto Abrahamsen.

Besly, Charles H. & Co., Chicago.—No. 14 Besly spiral disc grinder with geared lever feed table in operation, Helmet spiral circles, Helmet babbitt, Helmet oil, Helmet temper taps of all descriptions. Represented by Edward P. Welles and C. A. Knill.

Bethlehem Steel Company, South Bethlehem, Pa.—Special structural steel shapes, special design of forged steel jack, tool steel, stay bolt iron. Represented by W. C. Cutler, W. R. Shimer and George Costello.

Bettendorf Axle Company, Davenport, Iowa.—All steel 100,000-pound steel box car complete, equipped with the Bettendorf single I-beam center sill and cast steel center sill ends and Bettendorf all cast steel trucks with journal boxes cast integral and Bettendorf I-beam bolsters; one Bettendorf single center sill 36-foot 30-ton steel stock car underframe equipped with Bettendorf swing motion trucks, Bettendorf trucks and bolsters; one 40-foot 100,000-pound all steel drop bottom gondola car equipped with Bettendorf single I-beam center sill, cast steel center sill ends, Bettendorf all cast steel trucks. Represented by W. P. Bettendorf, J. W. Bettendorf, J. H. Bendixen and G. N. Caleb.

Bickford Drill & Tool Company, Cincinnati, O.—A working exhibit consisting of a five-foot full universal radial drill, motor driven. Represented by H. L. Beeler, H. M. Norris.

Bingham & Taylor, Buffalo, N. Y.—Improved journal box cover and improved pedestal. Represented by W. P. Taylor and James W. Gibney.

Bird-Archer Company, 90 West Street, New York.—Chemicals for boiler feed water, coach cleaner, Filion vestibule folding trap, Fritts anti-waste grabber, Anderson-Lacy electric headlight. Represented by P. B. Bird, V. O. Lawrence and Nat. P. Lane.

Bliss Electric Car Lighting Company, Milwaukee, Wis.—Axle driven head end system type C-2, individual car lighting equipment type C-3, export equipment type E-1, Santa Fe equipment type F, Pullman equipment type A, type L generator, type E generator with suspension, type K generator, train line couplers, tungston, tantalum and high efficiency carbon lamps. Represented by Col. Jno. T. Dickinson, W. L. Bliss, F. Urban, A. W. Berresford and Geo. Mueller.

Boker & Co., Hermann, New York.—Tool steel, Novo drills and Novo patent sections. Represented by Ellsworth Haring and O. H. Reynolds.

Bowser, S. F. & Co., Fort Wayne, Ind.—Bowser system of oil storage, long distance self-measuring pumps, power pump, adjustable-measure cabinets, small self-measuring outfits, tanks and pumps for machine and paint shops, roundhouses, engine rooms, storerooms. Represented by C. A. Dunkelberg and W. T. Simpson.

Brewer Brothers Company, Philadelphia.—Patent folding traps for vestibuled cars, samples of wrought iron and steel hardware. Represented by Charles E. Griffith, A. Brewer, R. Brewer and M. C. Brewer.

Brill Company, J. G., Philadelphia.—Brill truck No. 27 E 3 and on exhibit track a Strang gas electric car equipped with Brill No. 27 trucks. Represented by Coleman P. Brown, Samuel M. Curwen, J. W. Rawle, W. H. Heulings, Jr., W. S. Adams and S. M. Wilson.

Brown & Sharpe Manufacturing Company, Providence, R. I. —No. 3-A heavy universal milling machine, No. 5-B heavy plain milling machine, No. 3 vertical spindle milling machine, and following attachments: vertical spindle, universal, high speed, rack cutting, slotting, indexing. Represented by R. T. Eaton, C. A. Ballou, H. McGregor and John Parker.

Buckeye Steel Castings Company, Columbus, Ohio.—Major couplers fitted with various operating mechanism. Buckeye cast steel body and truck bolsters, Buckeye cast steel truck frames and Buckeye cast steel pivoted yokes. Represented by S. P. Bush, George Greebey, A. H. Thomas, George T. Johnson and J. C. Whitridge.

Buffalo Brake Beam Company, 30 Pine Street, New York.—Special all steel brake beams, standard solid beams all weights, forged steel brake heads, forged fulcrums, forged wheel guards, forged chain clips, special safety hangers, steel back brake shoes. Represented by S. A. Crone, E. Strassburger, R. C. Fraser, C. E. Barrett, E. C. Farlow and C. J. Zacher.

Burroughs Adding Machine Company, Detroit, Mich.—Burroughs adding and listing machines, special machines arranged for railroad shop accounting. Represented by F. A. Willard, T. M. Jones, I. L. Berk, F. Spiekerman, F. E. Woodward and E. S. Newman.

Bush & McCormick, Columbus, Ohio.—McCormick friction draft gear, McCormick hand switching brake, Bush anti-friction center bearing, Woods' anti-friction center and side bearing. Represented by S. P. Bush, Jno. H. McCormick and Edwin S. Woods.

Butler Drawbar Attachment Company, Cleveland, Ohio.—Friction and spring draft gears, Piper friction gear with standard springs, Piper friction gear with special springs, Tandem spring gear, 6¼ by 8-inch springs, wood underframe; tandem spring gear, 8 by 8-inch springs, steel underframe. Represented by Geo. L. Weiss and W. B. Waggoner.

Calculagraph Company, New York, N. Y.—An instrument containing clock work mechanism and printing machinery which subtracts and records elapsed time furnishing absolute accuracy for the basis of shop cost operation. Represented by Philip R. Simmonds.

Car Lubricator Company, Utica. N. Y.—Metal frame journal lubricator, with cotton web and wire wicks. Represented by Geo. J. Bingham, B. T. Gilbert and G. P. Simmons.

Cardwell Manufacturing Company, Chicago.—Draft gear, side bearings, center plates. Represented by J. R. Cardwell, C. H. Tobias and W. G. Krauser.

Carey, Philip Manufacturing Company, Cincinnati, Ohio.—85 per cent magnesia locomotive lagging, 85 per cent magnesia pipe and boiler coverings, train pipe coverings, asbestos and felt pipe coverings, asbestos sheathings, millboards and fibers, asbestos packings and gaskets, asbestos cold water paints, insulating materials, magnesia flexible cement, roofing, magnesia roofing paints, asphalt paints, deadening and building felts, lith and linofelt freight car roofing. Represented by N. S. Kenney, Steve J. Bowling, W. I. Kelley, J. G. Howley and W. H. Scobie.

Carborundum Company, The, Niagara Falls, N. Y.—Carborundum grinding wheels and sharpening stones in many forms, crystals of carborundum. Represented by George R. Rayner, R. B. Fuller, W. W. Sanderson and Charles Nicholson.

Celfor Tool Company, Chicago.—Celfor twist drill, Celfor chuck, Rich flat drill, Rich chuck. Represented by E. B. Clark, Russell Dale, W. F. Heacock, Wm. Brewster and W. E. McCabe.

Central Railroad of New Jersey—On exhibit track an air brake instruction car. Represented by H. L. Sandhas.

Champion Rivet Company, Cleveland, Ohio.—Special rivets for steel cars. Represented by W. H. S. Bateman.

Chase, L. C. & Co., Boston.—Chase's "Goat Brand" mohair car plushes, in high and low pile for car seats. A full line of colors and frieze patterns for coach and parlor car work. Exhibits showing process of manufacture. Represented by R. R. Bishop, Jr.

Chicago Car Heating Company, Chicago.—Vapor system of car heating, pressure system of car heating, steam hose couplers, steam traps, train pipe valves and hot water specialties. Represented by Egbert H. Gold, Frank F. Coggin, B. A. Keeler and Edward A. Schreiber.

Chicago Pneumatic Tool Company, Chicago.—One 419-foot compound belt driven air compresser, class G-CB, with mechanically operated inlet valves; complete line of Boyer & Keller pneumatic riveting, chipping and calking hammers; complete line of Little Giant, Boyer & Keller drills, reamers, wood boring machines and flue rolling and tapping machines; complete line of alternating and direct current electric drills, grinders, blowers and hoists; complete line of vacuum cleaners for residences, railroads, hotels, etc. Represented by Thomas Aldcorn, G. A. Barden, J. C. Campbell, Fred Severin, Jos. Parr, W. P. Pressinger, C. B. Coates, W. O. Duntley and J. W. Duntley.

Chicago Railway Equipment Company, Chicago.—Creco, National Hollow, Kewanee, Diamond, Reliance, Sterlingworth, Monarch Solid and No. 96 types of brake beams; Monitor bolsters, Creco journal box and lid, brake jaw, slack adjuster and roller side bearing. Represented by E. G. Buchanan, Geo. A. Cooper, F. T. DeLong, Fred. G. Ely, H. W. Finnell, Harry W. Frost, E. B. Leigh, Edwin F. Leigh, B. F. Pilson, Raymond H. Pilson, C. H. Williams, Jr., and C. P. Williams.

Cincinnati Machine Tool Company, Cincinnati, O.—One high speed 20-inch drill, one 24-inch sliding head drill with back gear, patent positive geared feed, quick return, patent geared tapping attachment, variable speed motor drive, one Cincinnati drill vise. Represented by Augustus H. Tuechter and Sherman C. Schauer.

Cincinnati Milling Machine Company, Cincinnati.—No. 4 vertical high power milling machine, No. 4 horizontal high power milling machine, set of milling machine attachments. Represented by Charles S. Gingrich and John L. Bishop.

Cincinnati Planer Company, Cincinnati, Ohio.—Forge planer, 37 by 37 inches by 8 feet, motor driven with speed box. Represented by B. B. Quillen and George Langen.

Clark, A. C. & Co., Chicago.—The Clark mechanical boiler cleaner. Represented by A. C. Clark and Wm. C. Smith.

Cleveland Car Specialty Company, Cleveland, Ohio.—Pressed steel carlines for inside and outside roofs, curved pattern for window roof and styles for baggage or express cars and for passenger cars, pressed steel side posts for passenger car, pressed steel window posts for passenger car, pressed steel lower deck roof support for passenger car,

pressed steel spring plank for car and tender trucks. Represented by Geo. L. Weiss, Joseph A. Costello and W. B. Waggoner.

Coale Muffler & Safety Valve Company, Baltimore, Md.—Safety valves. Represented by H. C. McCarty.

Coe Brass Manufacturing Company, Torrington, Conn.—Extruded metals in variety of special shaped bars and moldings. Represented by E. J. Steele, Wm. W. Cotter and Wm. H. Rippere.

Coe, W. H., Manufacturing Company, Providence, R. I.—Coe's gilding wheels, ribbon gold and aluminum leaf, Hiburnish bronze powders, Hiburnish bronzing liquid. Represented by Chas. H. Bowers.

Commercial Acetylene Company, New York.—Acetylene safety storage system as applied to car lighting, locomotive headlights, signal lights, etc.; tanks cut open to show method of packing with asbestos discs. Represented by Oscar F. Ostby, R. E. Bruckner, R. J. Faure, E. T. Sawyer and H. G. Doran.

Commonwealth Steel Company, St. Louis.—Steel castings, bolsters truck center frame, model of driving wheel center, on exhibit track a cast steel tender frame. Represented by Clarence H. Howard, H. M. Pflager and George E. Howard.

Consolidated Car-Heating Company, New York.—All kinds of heating apparatus for railroad cars. Represented by Cornell S. Hawley, W. S. Hammond and Thomas Farmer, Jr.

Consolidated Railway Electric Lighting & Equipment Company, New York.—System of electrically lighting steam railways by electricity, Consolidated axle light system, Kennedy regulator and indicating and recording attachment. Represented by P. Kennedy, J. L. Watson, Thos. L. Mount and L. J. Kennedy.

Crosby Steam Gage & Valve Company, Boston.—Locomotive valves, gages, blow-off valves, globe and angle valves, chime whistles, wheel pins, recording gages, indicators, etc. Represented by E. C. Kenyon, J. J. McCormick, Charles Carlson, H. B. Forbes and A. B. Carhart.

Curtain Supply Company, Chicago.—Ring No. 88 fixtures, Ring No. 89 fixtures, Forsyth No. 86 fixtures, Acme cable fixtures, Climax cable fixtures, Burrowes No. 83 fixtures and car curtain material. Represented by W. H. Forsyth, R. F. Hayes and S. W. Midgley.

Damascus Brake Beam Company, Cleveland, Ohio.—Waycott special high speed beams, Waycott freight beams, Damascus beams, improved adjustable brake heads, forged fulcrums. Represented by P. T. Handiges and Albert Waycott.

Davis, John Company, Chicago.—Regulating valves for steam hose coupling, back pressure valves, pump regulators, float valves, regulating valves for water, blow-off valves, regulating valves for air, balance valves. Represented by George F. Hughson.

Davis Solid Truss Brake Beam Company, Wilmington, Del.—Davis solid truss brake beams, Davis solid steel back brake shoe. Represented by Nathan H. Davis, Thomas C. Davis, C. Theo. Buchholz and Herman Bohl.

Dearborn Drug and Chemical Works, Chicago.—Samples of boiler tubes and photographs showing the pitting and corrosive action of strong alkali waters and waters containing free acid, and the heavy scale formation resulting from waters containing sulphates and carbonates of lime. A practical demonstration of the results from use of these different classes of waters is made, and thorough information also given as to the methods employed by the Dearborn Company in analyzing water supplies and preparing treatment to offset the injurious conditions, thereby keeping locomotive boilers free from scale, corrosion, or pitting, and preventing foaming. Represented by Robt. F. Carr, George R. Carr, J. D. Purcell, D. E. Cain, G. W. Spear and H. G. McConnaughy.

Detroit Hoist & Machine Company, Detroit, Mich.—Geared pneumatic hoists, 1 to 10 tons capacity; Detroit pneumatic locomotive turn table tractor, Detroit combination electric and pneumatic turn table tractor. Represented by J. C. Fleming and Frank B. Fleming.

Detroit [illegible] Company, Detroit, Mich.—Full line of Bull's eye lubricators from one to seven feeds, including a section [illegible] twenty-one and an air cylinder lubricator, a device whereby the air cylinder of air pump may be lubricated from the cab; packless radiator valves. Represented by A. D. Howard and A. B. Wetmore.

Diamond Machine Company, Providence, R. I.—Guide bar grinder [illegible] tool grinder. Represented by A. W. Graham.

Dickinson, Paul, Inc., Chicago.—Dickinson fire-proofed wood and cast-iron smoke jacks, caboose jacks, car ventilators, cast-iron building ventilators and chimneys. Represented by Wm. A. Bither, A. J. Filkins and J. A. Meaden.

Dixon Crucible Company, Jos., Jersey City, N. J.—Crucibles of all kinds, graphites, lubricants, pencils, motor greases, stove polishes, graphite paint, automobile grease, black lead, plumbago. Represented by De Witt Smith, L. H. Snyder, Neville J. Rowland, H. A. Nealley and W. Huston.

Dill Machine Company, T. C., Philada., Pa.—Slotting machines and Dill drives. Represented by T. C. Dill and Robert Russell.

Dressel Railway Lamp Works, New York.—Locomotive headlights, locomotive classification lamps, tail marker lamps, locomotive gage lamps, headlight burners, railroad switch lamps, semaphore signal lamps. Represented by F. W. Dressel, Robert Black, H. S. Hoskinson, F. W. Edmunds, E. W. Chester and E. W. Hodgkins.

Drouve Company, G., Bridgeport, Conn.—Anti-Pluvius skylights, Lovell window and sash operator, and Cibulas car ventilating sash operator. Represented by William V. Dee.

Duff Mfg. Company, Pittsburg, Pa.—Barrett car and track jacks and geared ratchet jacks, Duff ball bearing screw jacks, journal jacks, wrecking jacks. Represented by T. A. McGinley, Geo. A. Edgin, E. M. Fisher and R. A. Patterson.

Duner Company, Chicago.—Car closets. Represented by John C. Duner and F. L. Wells.

Edwards Company, O. M., Syracuse, N. Y.—Window fixtures, metal sash, steel extension platform trap doors and fixtures, sash balances, tin barrel spring rollers, railway devices. Represented by O. M. Edwards, E. F. Chaffee, Franklyn M. Nicholl, G. G. Norris and C. H. Rockwell.

Electric Railway Journal, New York.—(A consolidation of the Street Railway Journal and the Electric Railway Review) Copies of Electric Railway Journal and engineering books. Represented by James H. McGraw, J. M. Wakeman, H. W. Blake, Rodney Hitt, C. A. Babtiste and W. K. Beard.

Electric Storage Battery Company, Philadelphia, Pa.—Several types and styles of Chloride accumulator and Tudor accumulator car-lighting cells, standard and special types of cells for semaphore and inter-locking plants in signal service, sparking batteries, Exide vehicle cells, Chloride cells for heavy traction and for gasoline motor cars for railroad service. Represented by Chas. Blizard, John R. Williams, E. L. Reynolds, F. L. Kellogg and H. E. Hunt.

Elliott-Fisher Company, Harrisburg, Pa.—Billing machines and adding typewriters. Represented by D. E. Ruggles and C. M. Falconer.

Enterprise Railway Equipment Company, Chicago.—Dump car. Represented by Argyle Campbell.

Evans-Almirall & Co., New York.—Model apparatus of heating system for car barns, round houses, railroad shops and car building plants. Represented by Benj. Kauffman, C. D. Allan and Douglas Sprague.

Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio.—Falls hollow and Falls solid staybolt iron; samples nicked and broken to show the superior quality of metal and fibre. Other samples threaded and doubled flat on themselves and pieces hammered flat endways. Represented by C. M. Walsh, F. C. Lippert and Benj. C. Bradford.

Farlow Draft Gear Company, Baltimore, Md.—Four models of Farlow draft gear to steel underframes, one model of Farlow draft gear to wood draft sills, one model of Farlow draft gear to malleable iron draft sills. Represented by Dwight F. Mallory, I. O. Wright, B. S. Johnson, M. A. Garrett and C. M. Garrett.

Flannery Bolt Company, Pittsburg, Pa.—Tate flexible staybolts and tools for applying same to locomotive fire boxes. Represented by B. E. D. Stafford, J. Rogers Flannery, Harry A. Pike, Tom R. Davis and W. M. Wilson.

Flexible Compound Company, Philadelphia.—Flexible compound, Flexible black enamel, No. 75. Represented by Thos. H. Downward and Harry A. Brognard.

Forsyth Brothers Company, Chicago.—Metallic car window sash, high capacity buffing device for passenger car platform, high capacity friction draft gear, chaffee draw bar centering device, safety deck sash ratchets, car seat beaters. Represented by George H. Forsyth, A. L. Whipple and Louis A. Gray.

Foster Company, W. H., The, New York.—Staybolt machines, bolt cutting machines, staybolt drilling machines, nut topper, bolt altering machine, die grinder. Represented by B. D. Jackson.

France Packing Company, Tacony, Pa.—Metallic packing and fibrous packing for every class of service. Represented by A. W. France and G. E. Vansant.

Franklin Manufacturing Company, Franklin, Pa.—Century asbestos smoke jacks, patented, asbestos reinforced corrugated roofing or siding, asbestos building lumber and asbestos Century shingles, asbestos steam pipe coverings, wool felt pipe coverings, asbestos cements, asbestos rope and wick packings, Ambler asbestos ring air pump and throttle packings, 85 per cent magnesia boiler laggings. Represented by R. J. Evans, Geo. S. Stuart, Harry S. Hayward, L. B. Melville, Wallace W. Johnson.

Franklin Railway Supply Company, Franklin, Pa.—Franklin automatic driving box lubricator, McLaughlin metal flexible conduit, Franklin pneumatic fire door, Franklin automatic connector, Franklin hydraulic jack, Miser-Shaff water gage, Holland flexible joint, Franklin grate shaker, Terry grease plug, O'Connor fire door flange. Represented by J. S. Coffin, Samuel G. Allen, B. Haskell, A. G. Elvin, W. H. Coyle and Paul Weiler.

Frost Railway Supply Company, Detroit, Mich.—Harvey friction draft springs of various sizes, Detroit metal weather strips for coach windows, with models. Represented by Harry W. Frost, George A. Cooper and George L. Harvey.

Galena-Signal Oil Company, Franklin, Pa.—Reception booth. Represented by J. S. Coffin, V. P.; E. V. Sedgwick, H. Hillyer, Alex. Turner, J. A. Roosevelt, F. W. Dyer, E. H. Baker, F. A. Guild, B. H. Grundy, W. A. Trubee, G. L. Morton, L. H. Palmer and E. W. Grieves.

Garlock Packing Company, Chicago.—Metal and fibrous packings for locomotives and shop machinery. Represented by John N. Todd, Wm. Smith, F. A. Ebert, H. N. Winner and H. Peterson.

General Compressed Air & Vacuum Machinery Company, St. Louis.—Pneumatic railroad car cleaning truck with tool box and with automatic control valve, complete set renovators and cleaning tools, set of fittings (special) all in actual operation. Represented by Reuben C. Hallett and Frederic A. Coolidge.

General Electric Company, Schenectady, N. Y.—Railway motors G. E. 205, G. E. 209, G. E. 69 and G. E. 308 (No. 205 is designed for the Detroit tunnel railway); locomotive headlight set operated by small Curtis turbine, also 20 kilowatt train lighting set, Tantalum train lamps, switch panels for car lighting, application of motors to different tools, Universal saw bench, band saw, speed lathe. Represented by J. G. Barry, F. H. Gale, R. E. Moore, W. J. Clark and C. C. Pierce.

General Railway Supply Company, Chicago.—Metallic (steel) sheathing, National steel trap doors and lifting device, Schroyer friction curtain rollers and fixtures, Garland ventilators, National standard roofing, Flexolith composition flooring, Ideal roller center bearings, National automatic vestibule curtain catches. Represented by H. U. Morton, F. L. Wells and L. C. Bassford.

Gisholt Machine Company, Madison, Wis.—Motor driven 52-inch vertical boring and turning mill with two swivel heads, 24-inch Gisholt "Big Bore" lathe with 6¼-inch spindle hole, motor driven; Gisholt universal tool grinder for lathe and planer tools, motor driven. Represented by G. E. Gernon, Stanley C. Hanks, E. F. Muther, C. B. Carr, Charles Spalding and J. E. Brandt.

Gold Car Heating & Lighting Company, New York.—Railway car heating and lighting apparatus. Represented by E. E. Gold, W. E. Banks, E. B. Wilson, W. H. Stocks, J. M. Stayman, F. A. Purdy, G. F. Ivers, H. L. Leach, G. F. Collins, F. T. Kitchen, J. O. Brombaugh and R. Voges.

Goldschmidt Thermit Company, New York.—Welds on locomotive frames, wrought iron and steel pipes and other steel sections; crucibles, tripods and all necessary appliances for welding with Thermit; samples of Thermit, Nickel Thermit and ignition powder, specimens of metals prepared by the Aluminothermic process, free from carbon, such as chromium, maganese, molybdenum, ferro-vanadium, manganese-copper, manganese-zinc, manganese-tin, ferro-titanium, ferro-boron, chromium-copper. Welding operations on locomotive driving wheel spokes will be carried out at demonstration space, situated just beyond Marine Hall on the Million Dollar Pier. Represented by Henry S. Mann and A. M. Guenther.

Goodwin Car Company, New York.—Full size all steel hopper car, 100,000 pounds capacity. (Track Exhibit.) Represented by J. T. Gilman, L. W. Evans and J. M. Goodwin.

Gould Coupler Company, New York.—Gould M. C. B. couplers, malleable iron journal boxes, side-unlock coupler, miniature freight coupler, miniature tender coupler, Moritz M. C. B. couplers, Gould friction draft gears, cast-steel journal box, special malleable iron draft rigging and striking plates, Crown truck side frame with Crown bolster and Gould journal boxes, Gould steel passenger platform with friction buffer, Crown bolster (that has been tested), Gould special electric locomotive coupler, Hartman ball bearing center plates, Hartman side bearings, frame with Gould body bolster, Gould freight coupler, Gould friction draft gear and steel draft frames, Gould draft gear, new passenger coupler, rightning device and Gould vestibule. Represented by F. P. Huntley, Clarence E. Rood, S. R. Fuller, Jr., W. M. Rogvine, W. F. Richards, T. L. McKeen, Dr. C. W. Gould and H. N. Loomis.

Greene, Tweed & Co., New York.—Favorite reversible ratchet wrench, Palmetto braided and twist packings, Palmetto packing sets for Westinghouse air pumps, Palmetto packing sets for New York duplex pumps. Represented by F. E. Ransley and B. M. Bulkley.

Grip Nut Company, Chicago.—Grip nuts. Represented by Edward R. Hibbard, J. Wm. Hibbard and Herbert Green.

Hale & Kilburn Manufacturing Company, Philadelphia.—Railway car seats and shairs, pressed steel car seats, steel doors and sash, rattan seat covering. Represented by A. F. Old, H. T. Bigelow and B. F. Pilson.

Hanlon & Wilson, Wilkinsburg, Pa.—Vacuum cleaning machine for car cleaning, also for household and hotel use Represented by A. G. Wilson and Miss S. V. Wilson.

Harrington, Son & Co., Edwin, Inc., Philadelphia, Pa.—Plain four-wheeled traveler, to run on the lower flange of I-beam; geared four-wheeled traveler, to run on the lower flange of I-beam; Harrington screw hoist, improved type, one-ton capacity; Harrington Peerless hoist, improved type, one-ton capacity; Harrington differential hoist, one-ton capacity. Represented by Roger Sherron, E. Van Note, W. J. Somerset, R. F. Scott, P. Mullen, Z. B. Coes and A. M. Harrington.

Harvey, George L., Chicago.—Metal car stakes for flat and gondola cars. Represented by George L. Harvey.

Heywood Brothers & Wakefield Company, Wakefield, Mass.—Car seats. Represented by Bertram Berry.

Home Rubber Company, Trenton, N. J.—N. B. O. sheet packing, N. B. O. tubular gaskets, O. I. M. rod packings for high and low pressure, automobile casings and tubes. Represented by W. J. B. Stokes, Chas. E. Stokes, A. R. Foley and H. M. Royal.

Hunt-Spiller Manufacturing Corporation, South Boston, Mass.—Driving boxes, driving box shoes, Driving box wedges, piston heads, cylinder bushings, cylinder packing, superheater headers, piston valve cages, piston valve packing, false valve seats, eccentrics, eccentric straps, crosshead shoes. Represented by W. B. Leach and J. G. Platt.

Illinois Malleable Iron Company, Chicago.—Brazed steel back driver shoes, twist rod and steel lug car shoes, strap steel back and steel lug car shoes, coach Congdon shoes, twist rod

back driver shoes, chilled ends and inserts and steel hook; samples of railroad lock nuts, sample of smoke jacks for round houses, sample of Nokoros unions. Represented by Charles L. Sullivan and E. M. Marshall.

Independent Pneumatic Tool Company, Chicago.—Piston air drills, reaming, tapping and portable pneumatic grinding machines, pneumatic reversible flue rolling and wood boring machines, one-piece pneumatic long stroke riveting hammers, pneumatic chipping, calking, beading and scaling hammers, pneumatic wood saws, close quarter piston air drills, air hose and couplings, pneumatic holders-on and other air appliances, motorcycles. Represented by James B. Brady, W. O. Jacquette, J. D. Hurley, R. S. Cooper, J. P. Bourke, R. T. Scott and Geo. A. Gallinger.

International Traction & Power Company, Pleasantville, N. J.—Demonstrating a new crank engine. Represented by J. C. Reuter, Thomas F. Durham and Thomas F. Deegan.

Invisible Roll Screen Company, Brooklyn, N. Y.—Screens for dining cars, parlor cars and other cars to screen against dust and smoke; screens for offices and residences to screen against flies and mosquitoes. Represented by R. A. Bagnell.

Janney Car Coupler Company, E. H., Alexandria, Va.—Janney coupler and lifting device. Represented by E. H. Janney and Louis Storck.

Jenkins Brothers, New York.—Globe, angle, check, cross, radiator and gate valves, Sellers' restarting injectors, Jenkins Brothers patent gage cocks, diamond traps, improved automatic air valves, Jenkins '96 sheet packing, Jenkins Brothers pump valves, Graber indicating automatic water gages, Prouty wire valve wheels, Jenkins gasket tubing, Jenkins discs. Represented by A. C. Langston, J. H. Williams and Frank Martin.

Johns-Manville Company, H. W., New York.—Asbestos and magnesia railroad supplies, 85 per cent magnesia locomotive boiler lagging, pipe covering, asbestos and rubber packings for all purposes, including Kearsarge, Vulcabeston and Keystone; asbestos cement, asbestos wood, asbestos Transite lumber, asbestos roofing, Keystone hair insulator, asbestos mill board and fire felt sheets, Kearsarge handhole and manhole gaskets, J-M sectional conduit for underground insulation. Phœnix smoke jacks, linolite, electric fuses, blocks and switches, Victor combination meter, Magic boiler compound, Morris metallic packing and vitribestos linings and coverings. Represented by J. E. Meek, C. W. Gearhart, J. C. Younglove, S. B. Keys, E. C. Sawyer and T. G. Smallwood.

Johnson, Sinclair J., New York.—Model of New Era journal box and lid. Represented by Sinclair J. Johnson.

Justice, Philip S. & Co., Philadelphia, Pa.—Forty-ton "Reliance" hydraulic jack, 30-ton hydraulic jack, 25-ton hydraulic car box jack. Represented by Philip Justice Mitchell and O. L. Wright.

Kelly-Arnold Manufacturing Company, Wilkes-Barre, Pa.—Automatic air and steam connector. Represented by G. F. Rayer and J. T. O'Donnell.

Keystone Drop Forge Works, Chester, Pa.—Keystone connecting link, Keystone safety shackle hook, special locomotive and car forgings. Represented by Geo. H. Berlin.

Lackawanna Steel Company, Buffalo, N. Y.—Transparency illustrating entire plant and furnaces, steel works, mills, etc., in operation, also arrangements for handling material as well as specialties made of steel, installed. Case of sections, showing rolled shapes of open hearth steel made into I-beams, channels, angles, flats, squares, sheet bars and special shapes. Case of sections, showing Bessemer steel products in standard and light rails, splice bars, patent rail joints, tie plates, blooms, billets, etc. Exhibit of sheared and universal plates, car axles, steel tie, patent rail, and patent hook shoulder tie plate. Complete exhibit of Abbott rail joint plates, samples of concrete bars, including full set of tests. Lackawanna steel sheet piling. Represented by A. W. Starke, D. H. Van Pelt and F. E. Abbott.

Lancaster Machine & Knife Works, Lancaster, N. J.—Oval taper drill sockets and drills, lathe with shape attachment, bit braces, machine knives. Represented by W. J. Cant and R. J. Cant.

Landis Machine Company, Waynesboro, Pa.—Single head bolt cutter, motor driven. Represented by J. G. Benedict, W. C. Gladhill, H. L. Fisher.

Landis Tool Company, Waynesboro, Pa.—Universal tool grinder, motor driven; No. 3 Universal tool grinder, finished samples of work done by the machines. Represented by J. H. Hollinger.

Latrobe Steel & Coupler Company, Philadelphia, Pa.—Couplers, cast steel coupler yokes, auxiliary couplers, and Goodman wrecking hooks. Represented by J. G. Robinson and E. O. Warner.

Lawrenceville Bronze Company, Pittsburg, Pa.—Corinthian bronze driving boxes, McGillivray hydraulic valve, rod brass, journal bearings, Robertson blow-off valves, bevel wheel and shafting, finished; worm wheel in the rough and finished; 3-way tuyere cock; 2-way tuyere cock; assortment of unions, bevel wheel, pinions; 3-inch hose coupling with and without cap. Represented by Ed. Kerr and C. B. Ault.

Locomotive Appliance Company, Chicago.—Locomotive cylinders and valves, Allfree patent; Newton wrecking frogs. Represented by C. E. Walker, J. B. Allfree.

Lodge & Shipley Machine Tool Company, Cincinnati.—Patent head screw cutting engine lathe, 24 inches by 12 feet, motor driven, with ten-horse power Triumph 2 to 1 variable speed motor; three step cone screw cutting engine lathe, 16 inches by 8 feet, with Derrer attachment for turning odd shapes. Represented by R. G. English.

Love Brake Shoe Company, Chicago.—Armbrust steel connector locomotive driver shoes, flanged coach shoe, unflanged car shoe, electric railway brake shoes. Represented by C. W. Armbrust, W. H. Colebrook, Joy Love, D. L. Billings and Sydney Stein.

Lucas Machine Tool Company, Cleveland, Ohio.—No. 3 Precision horizontal boring, drilling and milling machine, railroad pattern power forcing press. Represented by W. L. Cheney and George A. Yost.

Lupton's Sons Company, David, Philadelphia.—Fireproof windows, Lupton hollow metal fire doors, Lupton rolled steel skylight, Waldmire louvres, Pond operating device for pivoted sash and louvres. Represented by Clarke P. Pond and John W. Watkins.

McConway & Torley Company, Pittsburg.—Pitt and Janney X freight couplers, Buhoup 3-stem passenger equipment, improved Janney passenger coupler, pivoted tender coupler, the Janney radial coupler for electric and interurban service. Represented by Stephen C. Mason, E. M. Grove, Wm. McConway, Jr., G. W. McCandless, H. C. Buhoup and I. H. Milliken.

McCord & Co., Chicago.—McCord journal box, National equalizing wedge, McCord spring dampener, McCord draft gear, McKim gasket, McCord force feed locomotive lubricator. Represented by J. A. Lamon, W. J. Schlacks, Wm. May, H. H. Newsom and D. W. McCord.

McIlvain, J. Gibson & Co., 1420 Chestnut St., Philadelphia.—A collection of woods, all of which are selected specimens. Represented by J. Gibson McIlvain, Jr., B. James McCormick, Thomas A. Dalton and Franklin H. Bogardus.

Marshall & Huschart Machinery Company, Chicago.—Various kinds of railroad machinery. Represented by Allen Ransom, George Stansbury and Geo. W. Hurd.

Mason Regulator Company, Boston.—Locomotive reducing valves, standard reducing valves for steam, water and air, balanced and lever valves, double seated and piston type, steam pump, damper regulator, gravity pump governor, air brake regulator, pump pressure regulators and Mason speed governors. Represented by F. A. Morrison and Eldon MacLeod.

Massachusetts Mohair Plush Company, Boston.—Plain and figured car plushes in a variety of colors. Represented by Joseph S. Seabury.

Michigan Lubricator Company, Detroit, Mich.—2, 3, 4 and 5-feed Michigan bullseye locomotive lubricators, 3-feed Michigan by-pass locomotive lubricator, Michigan air pump lubricator, Michigan locomotive automatic drain valves, Michigan stationary engine and compressor lubricators. Represented by Jno. B. Corliss and W. E. Bryant.

Modoc Soap Company, Philadelphia.—Perfectol car, locomotive and signal blade cleaner, Perfectol renovator for inside of cars, Perfectol metal polish. Represented by Henry Roever and Jas. McD. Holtzinger.

Mummert, Wolf & Dixon Company, Hanover, Pa.—Plurality Die bolt cutter, revolving oilstone edge tool grinder, revolving oilstone universal grinder, revolving oilstone scraper sharpener. Represented by E. S. Wolf and Clarence Buckey.

Murray, S. W., Milton, Pa.—Box car door, grain door, telescope stake. Represented by T. E. Twist and A. Dieffenderfer.

Nathan Manufacturing Company, New York.—Injectors, lubricators, general boiler appliances. Represented by E. S. Toothe, J. C. Currie, Jas. Minor, Chas. Kearns and L. Kassander.

National-Acme Manufacturing Company, Cleveland, Ohio.—Acme automatic multiple spindle screw machines with independent motor drive, Acme automatic multiple spindle screw machines with single belt drive. Represented by W. B. D. Alexander, W. S. Chase, E. C. Woolgar and J. F. Judd.

National Aniline & Chemical Company, Philadelphia.—Steelkote paints, of various grades for steel cars, under frames, body and truck bolsters, steel structures, bridges, signal towers, etc. Represented by Mr. J. W. Starr, 3d, Mr. W. C. Skinner, Mr. Charles R. Day and Mr. W. H. F. Tenney.

National Boiler Washing Company, Chicago.—National boiler washing system, flexible copper tubing, blow-off valves, Atlas side bearing. Represented by W. White.

National Car Coupler Company, Chicago.—National passenger and freight couplers, engine couplers, Sampson and Midget couplers for industrial cars, couplers for interurban service, National centering yoke, and Hinson emergency knuckle; center plates, wrecking frogs, switch points, heels and risers, blank gears, pinions and gears, chain blocks and cutter heads for coal mining machines. Represented by J. W. Harrison and W. A. Ruth.

National Car Seal Company, Chicago.—The Unoit freight car door lock seal. Represented by L. C. Weyand.

National Lock Washer Company, Newark, N. J.—Window fixtures, curtain fixtures, sash balances and sash locks, also the National Lock Washer. Represented by W. C. Dodd, Daniel Hoyt, F. B. Archibald and John B. Seymour.

National Malleable Castings Company, Cleveland, Ohio.—Tower, Climax and Vulcan couplers, National and Climax journal boxes, railway specialties. Represented by S. L. Smith, J. V. Davison, R. T. Hatch, H. D. Hammond, Roy Wright, W. E. Coffin, Chas. A. Bieder, J. J. Manning, Geo. V. Mardin, O. W. Loomis, K. R. Johnston, Benj. Nields, Jr., W. G. Kranz and F. R. Angel.

National Roofing Company, Tonawanda, N. Y.—Asphalt roofings, paints, casting dip, boiler and stack paint and asphalt cement. Represented by C. H. Newell, George W. Cullen and J. J. Case.

National Tube Company, Pittsburg, Pa.—Seamless steel tubing, seamless steel locomotive bells, seamless steel gongs, seamless steel locomotive tubes, safe ends, Kewanee unions, High Duty Metal valves, extra heavy iron body valves, Kewanee flange unions, flanged fittings, Y valves, National telescopic car stake. Represented by Geo. N. Riley, James G. Bateman, E. D. Gilberson, L. R. Phillip, L. F. Hamilton, C. R. Cumming and H. C. Brown.

New York Air Brake Company, New York.—Automatic hose connector, Forsyth patent safety train order signal. Represented by Wm. T. Henry, H. F. Bickel, Wm. Owens, P. Lovell, N. A. Campbell and J. E. Forsyth.

Norton Company and Norton Grinding Company, Worcester, Mass.—Mounted car wheels, showing tires with flat spots and tires from which flat spots have been removed on Norton car-wheel grinder; steel piston rods finished with Norton Alundum wheels on Norton grinding machines; a complete illustrative line of Norton grinding wheels made of Alundum; a complete illustrative line of India oil stones manufactured by Norton Company, samples of miscellaneous work ground by Norton Alundum wheels. Represented by C. O. Smith, H. N. Cudworth, Wm. L. Neilson and G. C. Montague.

Norton, A. O., Inc., Boston.—Norton ball bearing jacks. Represented by Harry A. Norton, Jos. O. St. Pierre, F. L. Gormley and B. B. Terrill.

Noscalon Company, New York.—Fire engine Noscalon machine, locomotive Noscalon machine, pawl and ratch[illegible] Noscalon machines, 100 and 350 horsepower, Noscalon material, samples boiler scale. Represented by W. H[illegible]ens, J. J. Healey, Jr., R. T. Weaver and Paul Gleises.

Oil Well Supply Company, Pittsburg, Pa.—Railr[illegible] specialties, brass valves for locomotives and malleable iron fittings. Represented by J. C. Bruff and D. J. Brown.

Pantasote Company, New York.—Pantasote car curtains and seat coverings, also an extensive exhibit of their new product Agosote for head linings, panels and partitions. A model of Agosote head lining with water running over it to show its water proofing qualities. Represented by John M. High, D. E. Bonner and Geo. N. Boyd.

Parker Car Heating Company, L't'd, London, [illegible] Parker anti-freezing and hot water system of car heating. Represented by Thomas Parker, John M. McEv[illegible] C. S. Parker, Jr., and Geo. H. Bryant.

Parkesburg Iron Company, Parkesburg, Pa.—Reception booth. Represented by H. A. Beale, Jr., A. J. Williams, Geo. Thomas, 3d, J. R. Humpton, C. L. Humpton, W. H. S. Bateman, H. Leora Maule and Amy T. Wright.

Perry Side Bearing Company, Chicago.—Old bearings in use from four to six years. One set from Chicago & Northwestern, with 270,000 miles service, new model for steam or trolley cars. Represented by H. M. Perry.

Phoenix Iron Works Company, Meadville, Pa.—Photographs, blue prints and literature describing high speed automatic cut-off engines, boilers, tanks and feed water heaters. Represented by John Dick.

Pilliod Company, Chicago.—Baker-Pilliod locomotive valve gear. Represented by C. J. Pilliod, H. J. Pilliod and F. E. Pilliod.

Pittsburg Automatic Vise & Tool Company, Pittsburg, Pa.—Two-way high speed vises, single swivel vises, pipe vises, automobile-motor boat vises, railway vise (very large), woodworkers' vises. Represented by G. P. Blackiston.

Pittsburg Equipment Company, Pittsburg, Pa.—Two cast steel side bearings, one with cast steel journal box attached, cast steel spring flank, cast steel end casting, cast steel end with spring seat cast on, one spring seat. Represented by O. S. Pullian and H. V. Seth.

Planet Company, The, Chicago.—Door hanger and automatic vestibule curtain hooks. Represented by H. J. Summers.

Pocket List of Railroad Officials.—New York copies of the Pocket List. Represented by J. Alexander Brown and Chas. L. Dinsmore.

Pressed Steel Car Company, Pittsburg, Pa.—On track near the Pennsylvania Electric terminal station an all steel passenger coach. Represented by O. C. Gayley, C. E. Postlethwaite, Chas. A. Lindstrom, W. H. Wilkinson, J. S. Turner, Victor Von Schlegell, C. D. Jenks, J. G. Bower, H. E. Swartz and A. P. Bowen.

Railroad Age Gazette, New York and Chicago.—Represented by E. A. Simmons, R. S. Chisolm, F. S. Dinsmore, L. B. Sherman, Jno. N. Reynolds, C. R. Mills, C. F. Albertson, Hugh M. Wilson, Daniel Royse, William Forsyth, F. W. Lane, C. H. Fry, George L. Fowler, S. O. Dunn, P. P. Fodrea, J. N. Nind, Jr., F. E. Lister, H. D. Horton, Miss Jennie Boyd and T. E. Crossman.

Railway List Company, Chicago—Represented by W. E. Magraw and C. S. Myers.

Railway Materials Company, Chicago.—"Rymco" Journal Boxes. Represented by Geo. L. Bourne, C. H. True, Geo. Hoeffle and C. M. Mendenhall.

Railway & Engineering Review, Chicago.—Represented by Willard A. Smith, Harold A. Smith, A. E. Hooven, Jos. F. Reed and W. E. Magraw

Ralston Steel Car Company, Columbus, Ohio.—Booth exhibit, models of steel underframe construction; tr[illegible]bit, gondola dump car of 100,000 pounds capacity; general service, box and stock cars of 80,000 pounds capacity. Represented by J. S. Ralston, J. E. Tesseyman, L. C. Brown and John L. Connors.

Restein Clement Company, Philadelphia.—Belmont packings for steam, water, ammonia, hydraulics, oil, g[illegible]s, acids,

etc.; steam hose, boiler washout hose, air pressure hose, water hose and tender hose; air pump and throttle packing. Represented by Clement Restein, Jules Restein, Norman B. Miller, W. R. Finnigan, James E. Sulger and E. N. Marcy.

Ritter Folding Door Company, Cincinnati.—Folding roundhouse, machine shop and depot doors. Represented by J. M. Crowe, W. Moore Wharton, C. D. Porterfield and H. O. Comstock.

Roberts & Schaefer Company, Chicago.—Photographic enlargments of Holmen type, belt conveyor type and the Holmen-Barrett type locomotive coaling stations. Represented by E. E. Barrett.

Robinson Company, Boston.—Robinson exhaust nozzle and Robinson rail anchor. Represented by Charles L. Snow, Frederic Parker and Frank Robinson.

Rubberset Brush Company, Newark, N. J.—Paint brushes for railroad use. Represented by A. L. Holtzman.

Russell, Burdsall & Ward Bolt & Nut Company, Port Chester, N. Y.—Machine bolts, carriage bolts, cold punched nuts, case hardened nuts, semi-finished nuts, castellated nuts, rivets, washers and brass goods. Represented by R. B. M. Cook, John Abel and T. S. Hickcox.

Rutherford Automatic Connector Company, Chicago.—Air hose connector for railway cars of all kinds. Represented by F. H. Rutherford and C. H. Carman.

Ruud Manufacturing Company, Pittsburg, Pa.—Automatic gas water heaters. Represented by J. C. Bartlett.

Ryerson, Joseph T. & Son, Chicago.—Lennox rotary bevel shear in operation, Ryerson high speed friction saw, flue welding machine, crank pin truing machine, portable automatic key-seating machine, valve seat facing machine, boring bar and punch and shear. Represented by Gilbert H. Pearsall, Edward T. Hendee, Frederick A. Gardner, Louis M. Henoch and John C. Kunzer.

Safety Car Heating & Lighting Company, New York.—All the apparatus for lighting cars by Pintsch system, showing both mantle and flat flame lamps, vapor system of lighting, axle light system in operation, steam heating apparatus including jacket system, new direct steam regulating system, all types of steam coupling, expansion and thermostatic traps, reducing valves, quick opening and train pipe valve operated from platform, improved safety valve and combination cock for expansion drums and sections of jackets and steam traps. Represented by R. M. Dixon, L. R. Pomeroy, D. W. Pye, William St. John, W. H. Hooper, C. B. Adams, W. L. Garland, J. H. Henry, A. C. Moore, G. E. Hulse, W. I. Thomson, J. M. Towne, H. G. Thompson, G. H. Chadwell and H. G. Darnell.

St. Louis Car Company, St. Louis.—Car seats, rattan goods, spiral journal bearings. Represented by A. H. Sissons, R. G. Hutchins and C. B. Hutchins.

Sargent George H., Chicago.—Sargent rerailers. Represented by George H. Sargent.

Scullin-Gallagher Iron & Steel Company, St. Louis.—Cast steel body and truck bolsters, cast steel M. C. B. coupler. Represented by Thos. M. Gallagher, R. H. Weatherly, B. V. H. Johnson, S. M. Dolan, F. L. Norton, R. B. Clark, Jr., James Timms and P. J. Howard.

Scully Steel & Iron Company, Chicago.—"Everlasting" blow-off valves, Scully flue-hole cutters, Lucas pneumatic tube expanders, Lovejoy roller expanders, Scully improved ball-bearing expanders, Kelly tube-flaring tools, railroad flue cutters, stay-bolt taps, spindle stay-bolt taps, reversible stay-bolt chucks, Scully stay-bolt headers, cone-bearing ratchet screw jacks, Wangler bevel shears, Scully rotary splitting shears, Bender steel grain doors, and Wood's patent flue sheet and fire-box. Represented by W. H. Dangel, T. T. Cavanagh, C. F. Lape, J. S. Bender, J. H. Allen, F. L. Patterson, Wm. H. Wood and Alexander B. Scully.

Sellers, William & Co., Inc., Philadelphia.—Working exhibit of No. 1 and No. 2 tool grinding and shaping machines, and drill grinding machine; working exhibit of 1908 non-lifting injector, with attached automatic lazy cock; sectional models of locomotive and stationary injectors, stop check valves, strainers, etc. Represented by Strickland L. Kneass, Charles T. Wilson, John D. McClintock and C. B. Conger.

Silk, McClellan & Co., Chicago.—Window fixtures, weather strips and window locks. Represented by Benj. S. McClellan.

Simmons, G. P., Utica, N. Y.—Journal lubricating device. Represented by G. P. Simmons, George J. Bingham and B. T. Gilbert.

Smith Company, William J., New Haven, Conn.—Smith one-lock and micrometer adjustable reamers. Represented by G. C. Parker.

Sprague Electric Company, New York.—Interlocking steel armored air brake and signal hose with standard fittings for railroad service, interlocking steel armored hose with fittings for the transmission of air, water and steam, steel armored cable and flexible steel conduit for interior and exterior electrical wiring, outlet and switch boxes and conduit fittings. Represented by Allan C. Bakewell, Harry H. Hornsby, W. L. Williams and Alfred E. Braddell.

Springfield Machine Tool Company, Springfield, Ohio.—High power rapid reduction lathe, 19 inches capacity, with oil pan and pump, and 7½ horsepower motor attached. Represented by Paul A. Montanus and Edward S. Montanus.

Standard Car Truck Company, Chicago.—Tender truck, freight truck, roller bearing center plates, ¼ size double action truck models, four ⅛ size truck models. Represented by J. C. Barber, Lee W. Barber and E. W. Webb.

Standard Coupler Company, New York.—Reception booth. Represented by George A. Post, George A. Post, Jr., A. P. Dennis and E. H. Walker.

Standard Metal Manufacturing Company, Chicago.—Brass castings, bronze castings, car brasses, locomotive brasses, Babbitt metals. Represented by Donald C. Barbee and Carl Penner.

Standard Paint Company, New York.—Ruberoid roofing for buildings and for box cars and refrigerator cars, insulating papers for refrigerator cars and cold storage work, iron and wood preservative paints, insulating varnishes. Represented by J. N. Richards, J. H. Thomas and J. G. Satterthwait.

Standard Steel Car Company, Pittsburg, Pa.—In machinery hall an all steel passenger truck, on exhibit track an all steel box car. Represented by John M. Hansen, J. B. Brady, R. L. Gordon and H. G. Macdonold.

Sterling Steel Foundry Company, Pittsburg, Pa.—Sterling automatic freight couplers and pilot couplers, open hearth cast steel locomotive frames, open hearth steel plantation car wheels. Represented by H. E. Wainwright, Jr., Uriah Tinker, Geo. J. Chandler, J. F. Robertson and J. W. Barth.

Stoever Foundry & Manufacturing Company, Lebanon, Pa.—3-inch motor driven pipe threading machine, with new type of nipple chuck. Represented by Ralph McCarty and Ed. R. Euston.

Storrs Mica Company, Owego, N. Y.—Small mica chimneys on incandescent gas lights, to illustrate the heat resisting qualities of the mica used in "Never Break" mica headlight and caboose lamp chimneys. Represented by A. P. Storrs and Charles P. Storrs.

Symington Company, T. H., Baltimore, Md.—Journal boxes, ball bearing center and side bearings, malleable iron car castings, locomotive castings of "Refined Iron." Represented by T. H. Symington, J. F. Symington, Donald Symington, C. J. Symington, W. W. Rosser, T. C. deRosset and A. H. Weston.

Tindel-Morris Company, Eddystone, Pa.—High duty cold sawing machines and inserted teeth high speed steel saw blades for high duty. Represented by L. N. Gruber and Lane Schofield.

Trenton Malleable Iron Company, Trenton, N. J.—The Trenton hopper door. Represented by R. C. Oliphant and Sinclair J. Johnson.

Trojan Car Coupler Company, New York.—Junior automatic car couplers. Represented by Henry D. Dumont and Charles C. Mickle.

Underwood, H. B. & Co., Philadelphia.—Standard portable boring bars for locomotive cylinders, rotary planing machine for valve seats on locomotives, portable locomotive frame

pedestal planer, new design crank pin turner and reborer, two-cylinder air or steam motor for driving portable tools, portable pipe bending machine. Represented by A. D. Pedrick.

Union Spring & Manufacturing Company, Pittsburg, Pa.—Coil and elliptic springs, pressed steel journal box lids and spring plates, Kensington all-steel journal box. Represented by A. M. McCrea, L. G. Woods, C. S. Foller, A. Stucki, T. B. Arnold and A. C. Woods.

U. S. Metal & Manufacturing Company, New York.—"Ureco" pneumatic track sander in operation, Davidson locomotive raiser, "Perfect" pressed steel car replacer, "Victor" cast steel car replacers, Columbia lock nuts, Western M. I. brake jaws, Feasible drop brake staff, Cliff & Guibert fire hose reel, Hillman locked clevis and turnbuckle, St. Louis Surfacer & Paint Company's coach and car (metal) surfacer finished on wood, coach, car and locomotive (metal) surfacer finished on metal, sheet canvas treated with "Metal" canvas preserver and "Metal" canvas roof paint, panels of "Metalsteel" paint, metal floor paint and locomotive, truck, cab and caboose enamels. Exhibition car on Mississippi Avenue track equipped with Dunham hopper door device, Feasible drop brake staff, Columbia lock nuts and painted throughout with the product of the St. Louis Surfacer & Paint Company. Represented by B. A. Hegeman, Jr., M. Jackson Crispin, G. L. L. Davis, F. C. Dunham, E. D. Hillman, Fred Atwater, John Varian and Henry Rau, Jr.

Uwanta Wrench Company, Meadville, Pa.—Monkey wrenches, combination wrenches. Represented by G. P. Bain.

Van Dorn Company, W. T., Chicago.—Steel car end. Represented by W. J. Van Dorn and John Sjoquist.

Ward Equipment Company, New York.—Heating apparatus for railway cars and locomotives, Ward steam couplers, in three sizes; Ward's end train pipe valves, automatic steam traps, pressure regulators, starting valves, steam gages and a complete line of fittings and other improved attachments for use in connection with car and locomotive heating equipment; Ward's car ventilator and Ward's automatic connector for steam, air and signal. Represented by John E. Ward, A. E. Robbins, Henry J. Horn and F. H. Bates.

Watson Stillman Company, New York.—Hydraulic jacks, portable shaft straighteners, hydraulic rail benders, independent pump jacks, hydraulic crank pin presses, hydraulic wheel presses. Represented by George L. Gillon and Edward A. Johnson.

West Disinfecting Company, New York.—Liquid soap, Beau Brummel liquid soap disinfectants, disinfecting appliances, sprayers, fumigating apparatus and products. Represented by E. Taussig, Chas. Auerbach and R. M. Fort.

Western Railway Equipment Co., St. Louis.—Acme brake slack adjusters, Western sill and carline pockets, Hoerr tandem draft gear, Linstrom eccentrics, Linstrom syphon pipes, Western bell ringer, car door fastenings, Economy slack adjusters, Western truck end castings, brake pins, Acme pipe clamps, Hoerr car doors, Western flush car doors, Missouri car doors, interchangeable car doors, St. Louis flush car doors, Downing card holders, Western brake jaws, Western angle cock holder, fish hook tie plates, Western tie markers. Represented by Louis A. Hoerr and S. H. Campbell.

Western Tool & Manufacturing Company, Springfield, Ohio.—Champion tool holders, Champion expanding mandrels, portable or movable benches, T-bolt heads, automobile non-clogging flue brush, screw feed tube expander and cutter, lathe dog, center oilers and cleaners, steel. Represented by Henry Morris, Robert J. Saim and E. V. Galen.

Westinghouse Air Brake Company, Pittsburg, Pa.—Reception booth. Represented by Jos. R. Ellicott, E. L. Adroon, E. A. Craig, F. T. Reese, S. J. Kidder and C. J. Olmstead.

Wheel Truing Brake Shoe Company, Detroit, Mich.—Various styles of abrasive brake shoes for truing up locomotive driver wheels and coach wheels. Represented by J. M. Griffin.

White Enamel Refrigerator Company, St. Paul., Minn.—Bohn's syphon system for refrigerator and dining cars. Represented by Gebhard Bohn and G. C. Bohn.

Whiting Foundry Equipment Company, Harvey, Ill.—Model of mechanical and electrical brake for hoisting mechanisms as applied to crane. Represented by C. A. Hardy and H. L. Mills.

Willard Storage Battery Company, Cleveland, Ohio.—Storage batteries for train lighting and for signal work. Represented by T. A. Willard, Robt. C. Shaal, C. C. Bradford and R. Norberg.

Wilmarth & Morman Company, Grand Rapids, Mich.—Five new Yankee drill grinders, as follows: one direct connected motor driven, style "D;" one wet grinder, style "PO;" one dry grinder, style "J A Point;" one bench grinder, style "L;" one combination cutter, reamer and drill grinder, style "BX;" also one new surface grinder and one Nelson loose pulley. Represented by Chas. E. Meech and S. Owen Livingston.

Wilson Manufacturing Company, Jas. G., New York.—Improved slat door with interlocking joints, specially designed for freight house doors, operated by chain gearing; continuous corrugated door with reinforced edges, sections of the wood slat door for round houses. Represented by A. H. Dodge.

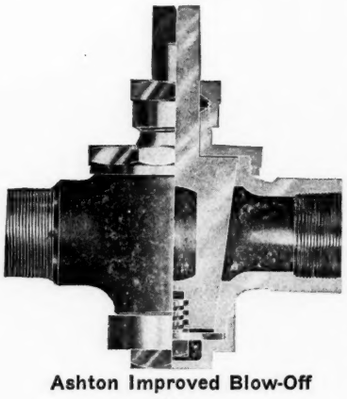
Wolff Truck Frame Company, Chicago.—Divided journal box frames, removable bolster retaining bar frames, solid type truck frames. Represented by F. A. Lester.

Wright Wrench Company, 3044 Chestnut St., Philadelphia.—Rapid adjustment monkey wrench. Represented by J. F. Wright and Bernard J. Crandley.

Yale & Towne Manufacturing Company, New York.—Electric "Triplex" hoists, overhead trolleys, chain blocks, Blount coach door checks, pad locks, station hardware, enlarged operating model of Yale lock, and coach cabinet locks. Represented by W. C. Bigelow, F. A. Hall and C. W. Beaver.

ASHTON IMPROVED BLOW-OFF VALVE.

The accompanying engraving shows outside and sectional views of the improved blow-off valve manufactured by the Ashton Valve Company, 271 Franklin street, Boston, which is specially designed for long service and ease of operation. The novel and valuable feature is the screw adjustment at the bottom, whereby in opening the cock the plug is raised slightly from its seat, which allows it to turn free in the case. In closing, the plug is drawn down to its seat, thus avoiding the friction and sticking so common in plug cocks. The cock is adjusted after grinding by placing the plug in its closed position, as shown, then turning the screw at the bottom up tight, and afterwards screwing on the outside bottom cap, so that it will hold the screw firmly in its position.



Ashton Improved Blow-Off Valve.

The exhibit of the Scullin-Gallagher Iron & Steel Company in addition to the Excel coupler, includes a matched cast steel body and truck bolster of the type of which the company has furnished nearly 500,000 in the past eight years. The design and manufacture of these bolsters have been given a great deal of study, with the result that there have been extremely few failures in service under ordinary usage. The company also has a full set of drawings of bolster designs made for a great many railroads.

The Ward Equipment Company, recently organized to handle car heating and ventilating devices, has met with pronounced success at this convention.